RELATIONSHIPS OF MANAGERIAL AND FINANCIAL FACTORS WITH ALTERNATIVE SUCCESS MEASUREMENTS USED BY COOPERATIVE GRAIN ELEVATORS IN OKLAHOMA

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

INTRODUCTION

General Problem

Information, particularly about managerial and financial aspects, is extremely valuable to decision makers in the cooperative grain industry. Goals or measures of success differ among decision makers in cooperatives. Primary goals range from monetary measures such as net savings after taxes, return on equity, or return on assets, to nonmonetary goals such as service to membership. As goals are established, decision makers seek information that will aid in the maximization of their desired goal.

Each goal or measure of success has a standard by which it is judged successful or unsuccessful. There are elements that positively or negatively affect these standards. Some elements may strongly influence more than just one goal. Identification of these elements, particularly of a managerial or financial nature, that influence the goals or measures of success is important to cooperative elevator decision makers. Knowledge of these relationships can provide them an opportunity for

additional insight for their own cooperative. By inspecting their own situation, they may use this information to highlight aspects previously ignored or considered unimportant. These discoveries can lead to better decisions made by board members and managers with benefits being passed on to member farmers.

Management's role is extremely important for business survival. Management integrates resources and tasks for goal attainment. The ability to tie together knowledge, skill and common sense into a workable framework determines management's success (Szilagyi, 1981). Therefore, evaluation of management's role and characteristic composition could determine those features that contribute to cooperative success. Identifying these features along with financial evaluations can make the difference in the viability of a cooperative during stressful economic times.

Farmers are affected by the changing economic conditions taking place in agriculture. Some factors contributing to economic stress in this industry include: low product prices relative to input costs of conventional agricultural methods, devaluation of land prices, difficulties in obtaining loans, high debt to equity or asset ratios, and cash flow problems. These occurrences have caused economic difficulties for farmers. Therefore, some farmers have either voluntarily or involuntarily left this chosen occupation.

Changes in the structure of agriculture at the primary or production level have an indirect effect on agribusinesses. When farmers have difficulties paying debts, it becomes a problem for those businesses which make their livelihood trading with this sector of the economy.

Since a farm cooperative is owned and patronized by farmers, a cooperative is sensitive to problems faced by the members. If farmers can't pay their bills, this is reflected in the cooperative by outstanding credit burdens. Therefore, the cooperative will experience repercussions from those problems faced by the membership.

As farmers find it more difficult to keep their enterprise afloat, they will choose to trade with the business that can benefit them most in the short run. There are many reasons why farmers are not willing to wait for patronage dividends that may eventually exceed the value they can presently obtain. First, cash flow is of extreme importance especially as it becomes more difficult to obtain operating loans. Second, there is no guarantee that they will realize much of the dividend in cash. Many times much of the dividend is kept by the cooperative in the form of retained earnings. There are also taxes and time value of money to be considered. As a result, the farmer will give up loyalty to a coopera-

tive in turn for what is perceived as the future existence of his or her operation.

Specific Problem

Understanding the importance of interrelationships between success measurements and factors which heavily influence success is necessary for successful decision making in cooperatives. Little work has been done since the early 1970's (Benitz, 1972; Oehrtman, 1975) to investigate these interrelationships and identify the relative impact managerial and financial factors have on success measurements in Oklahoma cooperative grain elevators. Few studies have involved managers in ranking success measurements used in their cooperatives.

This study will identify management and financial features that are associated with alternative measures of success in cooperative grain elevators in Oklahoma that managers have identified as important goals. Board members and managers can use the information provided in this study to better understand the relative importance of these interrelationships and thus make better decisions affecting cooperative success.

Objectives

The overall objective of this dissertation is to identify and quantify those factors which contribute to

alternative measures of cooperative grain elevator success in Oklahoma. Specific objectives include:

(1) Determine alternative measures of cooperative elevator success as perceived by cooperative managers.

(2) Identify those descriptive aspects related to Oklahoma cooperative grain elevators.

(3) Estimate and determine those significant economic and management factors related to alternative quantifiable cooperative grain elevator success measurements.

Specific objective one is accomplished by examining the results of a mail questionnaire sent to a group of elevator managers in Oklahoma. This information is presented in Chapter III. Information satisfying specific objective two comes from the literature review in Chapter II and from the details covered in Chapter III. The achievement of specific objective three is found in Chapter V which presents the results of statistical analysis of the data.

It should be noted that this study is exploratory in nature. Therefore, statistical techniques used were for the primary benefit of recognizing relationships among factors and not for the purpose of predictive interpretation.

Organization of the Dissertation

The following chapter will review research and information that are relevant and supportive as background and foundation for this study. Chapter III details the descriptive information observed from the questionnaire administered to cooperative managers and from the financial data collected. Chapter IV contains a description of statistical procedures and data used and Chapter V contains results from these procedures. Chapter VI contains the summary and implications of the study, as well as recommendations for further study.

CHAPTER II

REVIEW OF LITERATURE

What is a cooperative and what is there about this form of business that makes it so different from other forms of business? Roy (1969) defines cooperative as a

> business voluntarily organized, operating at cost, which is owned, capitalized, and controlled by member-patrons as users sharing risks and benefits proportional to their participation.

The Rochdale pioneers established the use of cooperative principles in 1844 in England. Agricultural cooperatives in the United States originated out of a dissatisfaction among farmers with the way their special needs were being met by input suppliers and processors (Beierlein, Schneeberger, and Osburn, 1986). In reaction to these circumstances, farmers grouped together and formed cooperatives to provide these needs themselves.

Unique Features of Cooperatives

Cooperatives have some unique features that distinguish them from other forms of business. Cooperatives are operated for the mutual benefit of their members. Cooperatives are allowed to trade with

nonmembers but not in an amount that is greater than the amount of business done with members. Cooperatives are democratically controlled by the members. Many cooperatives' policy is one vote per person. However, some cooperatives have voting rights based on the amount of patronage the member does with the cooperative.

Cooperatives are often called nonprofit organizations. This is because earnings above cost are distributed back to the membership in the form of patronage dividends or patronage refunds. These patronage refunds can be distributed in the form of cash or deferred patronage refunds. They are paid in proportion to the amount of business done with the cooperative. Individual members add these refunds to their other ordinary income and are taxed accordingly. Thus, as VanSickles and Ladd (1983) point out, there is a single tax on income in cooperatives.

Businesses that are not cooperatives are double taxed on their profits. They are first taxed on their company profits. A proportion of these after tax profits are distributed to stockholders in the form of dividends. These dividends are income earned from investment in the company and are, therefore, added to the individual's ordinary income and taxed. Thus, double taxation occurs since both the company and the investor pay taxes on the earnings.

Businesses that are not cooperatives are allowed to

return their profits to their customers in proportion to the amount of business transacted by each customer, just like cooperatives. By doing so, they will be taxed only once.[1] However, the goal of most of these types of businesses is to earn returns for their owners rather than their customers, so few choose this alternative.

Capital is viewed differently in cooperatives than in other business forms. Returns on equity capital are limited. The function of investment capital is to provide a base for operation. Since the cooperative is a service to a member's own business, rather than an investment in and of itself, members receive relatively low rates of interest on their capital invested.

Cooperatives also have a source of capital available that other types of businesses do not have; that is, deferred patronage refunds. Cooperatives are required to return at least 20 percent of the patronage refunds in cash each year. The remainder, or what is called deferred patronage refund, may be used as a source of capital and returned to members over a period of years.

This is called revolving fund financing. It is based on the idea that cooperative members should be willing to finance the growth of their own organization. The cooperative revolves the stock periodically, thus allowing older stock to be cashed in. The board of directors make decisions on when to cash in older stock

and the amount of dividend to be paid on outstanding stock. These decisions are based on the cooperative's financial condition and the availability of cash.

Patronage refunds in the form of stock cannot exceed 80 percent of the total patronage refund. Many cooperatives pay more than the required 20 percent of patronage refunds in cash. However, the member must pay taxes on the total patronage refund. If a member's effective tax rate is above 20 percent and he or she only receives 20 percent of the patronage refund in cash, then the member will pay more money in taxes on the full patronage refund than she or he would receive in cash from the refund. Cooperatives paying back only the minimum 20 percent of refunds in cash often experience disillusioned membership and loss of cooperative loyalty.

Other aspects unique to the cooperative form of business include open membership, neutrality in politics, and constant education. These features are distinguishing elements of cooperatives when compared to other business forms.

More details regarding basic fundamentals of cooperatives are presented by LeVay (1983) and Fischer (1984). LeVay discusses how theory, chosen and applied to the cooperative form of organization, is only as appropriate as the goal and attitudes of the cooperative itself. She remarks that there can be no standard model

which all cooperatives will follow. A cooperative intending to serve both its members and the community as a whole would not necessarily conform to the same theory as one whose objective was solely self-interest. Fischer (1984) presents an extensive review of cooperative literature in his dissertation and divides his discussion into three main areas: principles of cooperation; theoretical models of cooperative enterprise; and literature on cooperative finance.

Elements of Cooperative Success

There are several elements that have been reported to be contributing factors to cooperative success. Erdman and Tinley (1957) suggest four elements important to cooperative success:

(1) Suitable corporate and financial structure,

(2) Suitable records, accounts, and audits,

(3) Competent management, and

(4) Dynamic leadership

Jewett and Voorhies (1963) present a list of elements of cooperative success which includes capable and progressive management, qualified directors, equitable treatment of members, stable and loyal membership, good employee relations, favorable returns to producers, sufficient volume of business for economic operation, affordable bargaining and/or purchasing power, standardized quality of product or services,

adequate financing, comprehensive accounting and periodic auditing, adherence to sound cooperative principles, and dynamic planning and decisive program execution.

Management's Role

Beierlein, Schneeberger, and Osburn (1986) discuss the many challenges management in agricultural cooperatives face. Management needs to demonstrate to the membership the value of the cooperative and its principles. Membership composition may vary greatly in type of user, so the cooperative will be faced with the challenge of meeting the variety of needs of its members. The cooperative needs to attract qualified, well-trained members for its board of directors, who can effectively set the direction and the general policies for the cooperative. Equally important is the ability to hire qualified, well-trained managers who can effectively manage the cooperative. A stable and equitable capital base is also an important need for cooperatives.

McBride (1986) states that a serious flaw of cooperative management is that primarily problems of immediate importance are being handled. Many problems of lesser immediate importance are not being addressed. He suggests that cooperative leaders have adopted a reactionary rather than an anticipatory position. This

kind of management often inhibits new innovation and thus contributes to loss of competitive edge and market share over time.

The lack of keeping pace with the competition results in loss of loyal membership. Beierlein, Schneeberger, and Osburn (1986) state that many of today's farmers are less loyal to the cooperative unless they can see some direct advantage. Some ways cooperatives are trying to provide advantages to their membership are by offering volume discounts and other more equitable treatment.

Equitable treatment is based on the premise that each member pays their own way; thus, benefits and risks are in proportion to patronage or use of the cooperative. Jewett and Voorhies (1963) explain that

> Quantity discounts or minimum service charges are assigned on a basis that aims to equalize cost of services - least the large patrons subsidize the small operator or the small patron pay a disproportionate share for his required services.[2]

Without volume discounts and other such treatment, larger producers would be more inclined to withdraw business and membership from a cooperative. This would affect volume traded and reduce economic efficiency and bargaining power of a cooperative.

Member education is one of the important functions necessary for cooperative success. McBride (1986) suggests that a cooperative without an education program

will last a generation and a half. He stresses the importance and responsibilities of cooperatives in educating young and newer members and developing leadership. Some cooperatives have established junior boards of directors for this very purpose.[3]

The importance of member education is evident in the case of the Farmers Cooperative Society in Garner, Iowa (Huenemann, 1971). The cooperative members had lost interest in their cooperative and had little desire to support it. Management took action by setting an immediate goal of developing well-informed directors, employees, and members working together for the common good of the cooperative. To obtain this goal the board of directors invited their members to a series of one night workshops, offered during members' least busy work time. These workshops focused on improving members understanding of their cooperative, explained why they should be loyal supporters, and showed them that by working together each individual would profit. Topics covered included purpose of cooperatives, aims and purpose of their particular cooperative, credit and credit terms, building programs, products and services available, revolvement policy, marketing activities, sales and savings, changes in member equity, and new programs. The project was a success. Volume increased and sales went up. Members began to feel it was their cooperative and began to take an active part in

expressing opinions to management and convincing other members of the cooperative's needs. This resulted in fuller member support for cooperative projects.

Another key role in member relations involves employees' attitude toward members, their tasks, and their organization. Jewett and Voorhies (1963) believe that cooperatives would benefit by using employee training and education, as a basis for promotion, as a means of creating greater potential efficiency, as a step in improved customer relations, and as a source of on-the-job satisfaction.

How Managerial Skills Play a Role In Success

Beal, Warren, and Duncan (1971) discuss the relationship of training, knowledge, and experience with managerial performance and economic success of their cooperatives. There are two measures of success used. First, management performance is measured by responses of managers to a series of questions about how they performed their managerial roles. Second, economic success of the cooperative is measured by net operating revenue and by combining the ratios of net saving to fixed assets and to sales.

The best predictor of management performance seemed to be the amount of formal education they had, but only a small positive relationship existed between education and economic success. Knowledge of certain aspects of

margin determination and financing along with greater knowledge of their product lines was found to be positively related to economic success and to management performance. Knowledge of economics and products seemed to be a much better predictor of management performance and economic returns than the educational and training factors. In this study, the best single predictor of economic success was the amount of management experience. They concluded that education, training, and knowledge were all reasonably good predictors of management performance, but only knowledge and management experience were found to predict economic success.

Babb and Van Slyke (1965) used an experiment to relate three factors: (1) management success of an actual country elevator, (2) performance in a farm supply business management game, and (3) evaluation of managerial ability by actual managers, to each other and to specific psychological and personal history factors. The accumulative net worth at the end of the game was used as the criterion of success in the business management game. Measurements, however, demonstrated that success in the game did not appear to be related to real life. Several things contributed to this. Peer rankings by players were somewhat a status and popularity contest. These rankings reflected true managerial ability and were capable of predicting success in the actual business only to a very limited extent.

Oehrtman (1975) used factor analysis to determine the underlying factor structure of some economic, sociological, and psychological variables managers believed were relevant to managerial success. Some hypotheses that were derived from the conclusions of the analysis include:

(1) More educated and higher paid managers were more likely to receive a management incentive, but have higher overhead costs than less educated and lower paid managers.

(2) Profitability and experience increased with age of manager.

(3) Older managers were more rigid disliking change or risk.

(4) Older managers controlled larger cooperatives.

(5) Low achievement motivation, poor business practices, and dissatisfaction with the Board of Directors were all positively related to financial liquidity.

(6) An overly liquid financial position was a safety margin used by poor managers.

Board Of Directors

The board of directors plays a crucial role in influencing cooperative success. Beierlein, Schneeberger, and Osburn (1986) state that "a cooperative can be no better than its board of directors and the members

who elect them."[4] Boards of Directors must identify today's and tomorrow's needs in terms of goals and purposes of the cooperative (McBride, 1986). Boards of Directors need to use foresight to identify future members, their needs, and ways to meet these needs.

Boards of directors must pay attention to the needs of all members. Some members or groups of members have special needs. This is particularly true for young farmers who often have capital and cash flow needs that differ from those of older, more established operators (Beierlein, Schneeberger, and Osburn, 1986). Down-playing the needs of these younger members may lead to their alienation and eventual withdrawal from the cooperative. They usually represent the organization's future. It is through the process of self-examination and self-renewal that a cooperative can ensure its future success by meeting the needs of the membership.

French, Moore, Kraenzle, and Harling (1980) describe the ideal board member as meeting the following performance criteria:

(1) Committed and interested in the success of the cooperative,

(2) Available for cooperative meetings and functions,

(3) Briefs himself/herself before meetings,

(4) Is a capable counselor, and

(5) Has suggestions and observations that are valuable to management.

Salary And Compensation

The setting of wages and salaries is often overlooked as a vital function of management. If an employee is not satisfied with their salary, working conditions, or prospects for advancement, they will seek to leave (Duft, 1973). Many times directors have been reluctant to pay managers well. It is often difficult for directors to accept paying a manager more than the director is earning himself/herself. Continued success in the future will require boards to change this behavior. This is especially true when cooperatives reach a size that can no longer be handled as a small business (Beierlein, Schneeberger, and Osburn, 1986). The larger size business requires analytical skills from an individual that will demand a higher salary.

A study done for the National Council of Farmer Cooperatives reports that average compensation paid cooperative top management was lower than that paid to top management in other corporations (French, Moore, Kraenzle, and Harling, 1980).

Larson (1976) reports that a strong correlation exists between executive compensation and the cooperative's assets, sales, and level of member benefits. The

report also yields the following information. Average compensation increases consistently with cooperative size and tenure. As sales volume increases so does the chief executive's income.

French, Moore, Kraenzle, and Harling (1980) remark that

> Many cooperative bonus programs are more a sharing of the wealth than true incentive programs. One cooperative principle is operation at cost. If managers are given high bonuses they are increasing costs to some extent. Hence, many boards like to keep bonuses as small as possible.[5]

Measures of Efficiency

It is important to identify elements or factors that can be used to measure a business's efficiency. McBride (1986) discusses "proxies" that might be used to measure engineering efficiency. Among the "proxies" mentioned are budgets, financial analysis, liquidity, salary and wages, number of employees, ratio of net income to total assets, ratio of net income to member equity, gross net margins, ratio of total liabilities to member equity, marketings, volume, and trends, personnel numbers, trends, and training, number of patrons - members and nonmembers, and total number of members. He also suggests using a total business audit. Areas and items that should be audited include: (1) management, (2) board of directors, (3) organizational arrangement, (4) employees, (5) physical facilities, (6) inventory,

(7) marketing and procurement practices, (8) transportation, (9) financial, (10) plans and budgets, (11) office procedures, and (12) credit policy. McBride comments that some of these had short-term performance connotations while others were more long-term oriented.

Financial Aspects

Financial "health" and the detection of weaknesses is a must in today's economic environment. Platt (1985) discusses five financial traps companies face that can lead to failure. "Trapped" companies are:

(1) Pinched by short-term debt,

(2) Caught in the cash-flow cycle,

(3) Buried under current assets,

(4) Squeezed by equipment, and/or

(5) Lost with too little capital.

According to Altman (1968), financially-distressed firms can be separated from the non-failed firms one year before the declaration of bankruptcy at an accuracy rate of better than 90 percent. This can be done by examining financial ratios. Retained earnings divided by total assets is one of Altman's most significant ratios in predicting bankruptcy.

With the hundreds of ratios computed from financial data, Chen and Shimerda (1981) attempt to determine which ones should be selected for analysis of potential

firm failure. They conclude that financial ratios could be grouped into seven categories:

(1) Return on investment

(2) Capital Turnover

(3) Financial Leverage

(4) Short-term Liquidity

(5) Cash Position

(6) Inventory Turnover

(7) Receivables Turnover

From these seven groups one ratio could be chosen to represent each group. This ratio should be selected on the basis of its ability to account for most of the information provided by all the ratios in that group.

Many ratios are highly correlated. One example is the high correlation between debt/net worth and debt/assets. They are highly correlated because they are variates of the same equation:

Total Assets = Total Debt + Net Worth.

Inclusion of more than one ratio from the seven categories leads to multicollinearity among ratios and distorts the relationship between the dependent and independent variables.

> Because ratios belonging to the same factor are highly correlated and reveal primarily the same information a decision maker can select an appropriate set of financial ratios that best represent these seven factors for the prediction of firm failure.[6]

ENDNOTES

[1]There are additional criteria a company must meet in order to quality for tax exemption status.

[2]Alyce L. Jewett and Edwin C. Voorhies, Agricultural Cooperatives: Strength in Unity, Danville, Illinois: Interstate Printers and Publishers, Inc., 1963, p.44.

[3]A junior board of directors participates in regular board meetings and events, but in most cooperatives do not have voting rights. It is a training experience for potential board members.

[4]James G. Beierlein, K. C. Schneeberger, and D. D. Osburn, Principles of Agribusiness Management, Englewood Cliffs, N.J.: Reston Book, 1986, p. 180.

[5]C.E. French, J.C. Moore, C.A. Kraenzle, and K.F. Harling, Survival Strategies for Agricultural Cooperatives, Ames, Iowa: Iowa State University Press, 1980, p. 225.

[6]Kung H. Chen and Thomas A Shimerda, "An Empirical Analysis of Useful Financial Ratios", Financial Management, 10(Spring 1981): p. 59.

CHAPTER III

DESCRIPTION AND RESULTS OF THE SURVEY

This chapter is devoted to a description of the information from the questionnaire and the data collected. There were approximately 77 cooperatives trading grain, soybeans, and/or soybean oil and meal in Oklahoma in 1985 (USDA, Farmers Cooperative Statistics, 1986).

Figure 1 shows the location of those cooperatives responding to the survey and releasing their financial records over the past five years. There is a noticeable concentration of elevators on the western half of the state. This is due to geographical conditions that make the western side of the state more conducive to wheat farming than the eastern side. Western Oklahoma is flatter and more arid than eastern Oklahoma which is forested and hilly.

Questionnaires were sent to fifty grain cooperatives since written consent was granted for the use of five years of their financial data. Thirty-seven cooperatives, (74 percent of those surveyed), returned the questionnaire after one mailing and one telephone

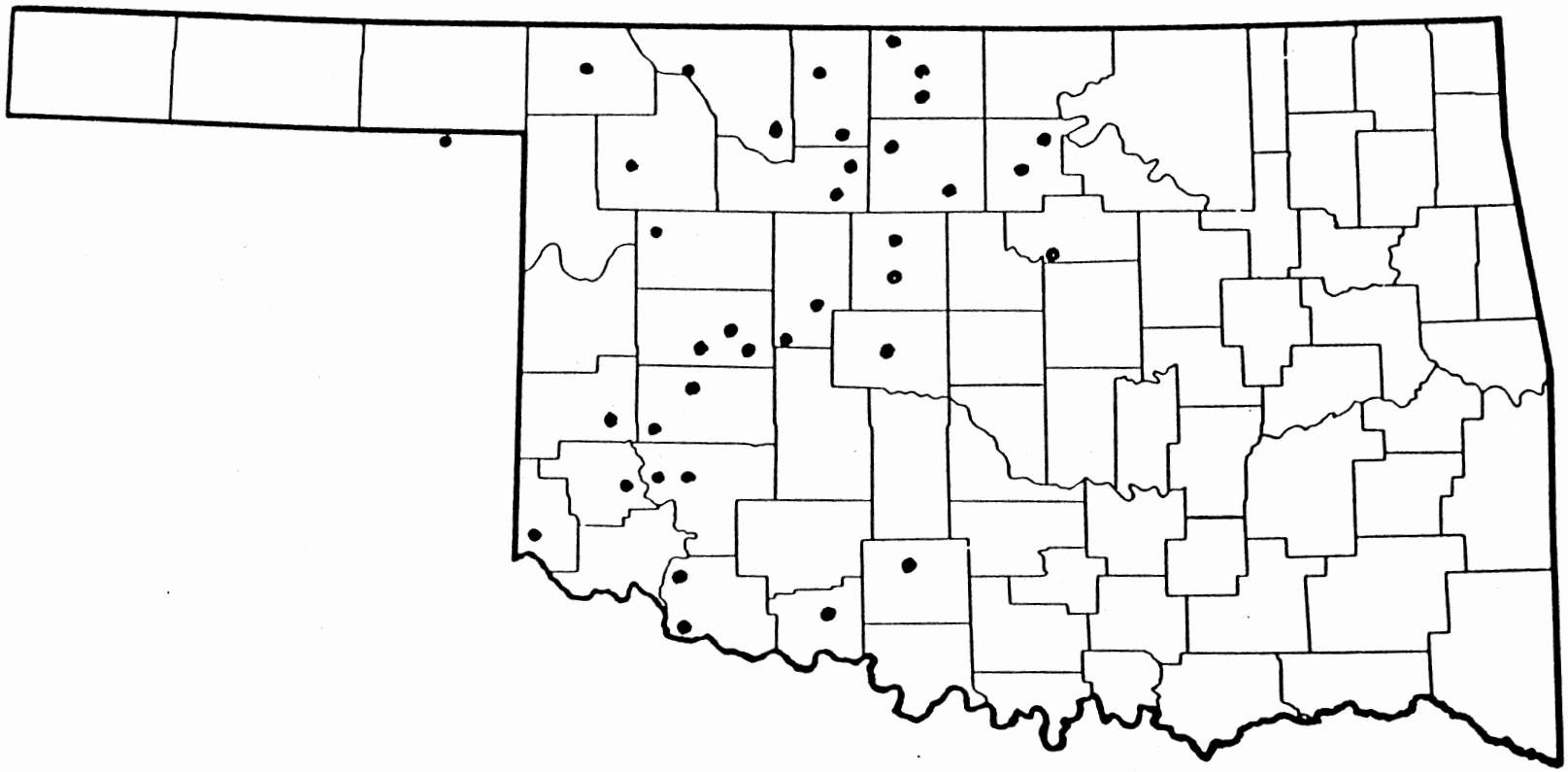

Figure 1. Location of Oklahoma Cooperative Grain Elevators Participating in the Study

follow-up call.[1] The questionnaire was based upon a one year time period, 1985. Financial information was obtained from Blubough and Campbell, State Auditors for Cooperatives, located in Enid, Oklahoma.[2] The five years of data collected was from 1981 through 1985.

In order to gain additional information about the cooperatives, the respondents were divided into three size categories. Divisions were made according to the average of the cooperatives' total assets over a five year period.

Cooperatives with a five year average of total assets less than 1.5 million dollars were grouped into the small size category as seen in Table I. Medium sized cooperative elevators were in the range of 1.5 to three million dollars. Those cooperative elevators with average total assets exceeding three million dollars were considered large in size. Thus, these imposed boundaries resulted with 7 small, 22 medium, and 8 large size cooperative elevators.

The information from the questionnaire and the data collected can be separated into several categories: General Descriptive Information, Membership, Board of Directors, Management, Employees, Goals and Objectives, Strategies, Financial Aspects, and Challenges. A discussion of each of these categories follows.

TABLE I

SIZE CATETORIES OF COOPERATIVES IN THE STUDY

Cooperative Size	Five Year Averages of Total Assets (Million Dollars):
Small Cooperatives:	Less that $1.5 million
Medium Cooperatives:	Between $1.5 and $3 million
Large Cooperatives:	Greater than $3 million

General Descriptive Information

The average volume of wheat traded by the cooperatives surveyed was 778 thousand bushels. Large cooperatives traded nearly four and one half times more volume of wheat than the small cooperatives. The average radius of all cooperatives' grain procurement area was 18.8 miles. Large cooperatives' average radius was seven to ten miles greater than the distance of medium or small cooperatives' trading radius.

The average number of competitors for all cooperatives was four elevators. Two of these competitors were other cooperatives.

Managers indicated that three hauling methods were used by cooperatives to transport their grain: truck, rail, and/or barge. It is assumed that grain ownership was transferred from the cooperative to another business prior to the point where the grain was loaded on the barge. It is believed that managers who responded knew the grain was transported by barge even though actual ownership of the grain was transferred. The overall average for the cooperatives consisted of 335 thousand bushels hauled by truck, 508 thousand bushels hauled by rail, and 87 thousand bushels hauled by barge. Small cooperatives tended to use more trucking, while large and medium cooperatives used more rail than truck or

barge. Large cooperatives were the predominant users of barge transportation.

Forty percent of the cooperatives surveyed had branch elevators and were centrally managed. This implies more management responsibility and more volume traded for these cooperatives.

A summary of the general descriptive information for all cooperatives responding to the questionnaire is presented in Table II.

Membership

Table III contains summary information on the membership of cooperatives surveyed. The cooperatives averaged 630 members in their cooperatives. Large cooperatives had twice the average membership of the smaller cooperatives, while the medium cooperative's membership was below the overall average.

The average attendance at the annual meeting was 24 percent of the membership. This indicates a problem with active involvement by the membership.

Only 16 percent of the cooperatives published newsletters for their membership. The frequency of publishing ranged from once a month to once a year. Each size category had at least one cooperative that published a newsletter, implying size was not significant in providing this type of service.

TABLE II

GENERAL DESCRIPTIVE INFORMATION ABOUT ALL COOPERATIVES RESPONDING TO QUESTIONNAIRE

Characteristic	All Cooperatives
Average Volume	778 thousand bushels
Average Radius of Grain Procurement	18.8 miles
Average Number of Competitors	4 elevators
Average Number of Competitors Which Were Other Cooperatives	2 elevators
Average Amount of Grain Transported by:	
Truck	335 thousand bushels
Rail	508 thousand bushels
Barge *	87 thousand bushels
Number of Cooperatives Having Branch Elevators	40 percent
Offer Volume Discounts to Members	60 percent

* It is assumed that grain ownership was transferred from the cooperative to another business at the point where the grain was loaded on the barge.

TABLE III

MEMBERSHIP INFORMATION ABOUT ALL COOPERATIVES RESPONDING TO QUESTIONNAIRE

Characteristic	All Cooperatives
Average Membership	630 Members
Average Annual Meeting Attendance	24 Percent
Cooperatives Publishing Newsletter	16 Percent
Cooperatives Offering Unprofitable Services	70 Percent
Cooperatives That Offer Unprofitable Services But Feel The Services Should Be Discontinued	42 Percent

Seventy percent of the cooperatives offered services that did not break-even. Forty-two percent of these cooperatives indicated that services that do not break-even should be discontinued. Medium cooperatives on the average felt stronger about discontinuing services that do not break-even than the other two size categories. Eighty-six percent of the small cooperatives offer services that do not break-even, compared to 68 percent of the medium size cooperatives, and 63 percent of large cooperatives.

The cooperatives listed an array of services that they felt should be discontinued because they did not cover costs. Among those listed were seed cleaning, the feed mill, feed grinding and delivery, sprayer and spreader rental, and animal health products as seen in Table IV. The service station, which offers tire repair, tire sales, oil changes and wash jobs, was another service cooperatives felt should be discontinued. It was also suggested that the farm store be reorganized.

One of the reasons the cooperatives may choose to continue offering services that do not break-even is their emphasis on service to membership as a major success factor. The managers were asked to rank success measurements. For many cooperatives the association between high ranking of service to membership and a cooperative's commitment to continue offering unprofit-

TABLE IV

TYPES OF UNPROFITABLE SERVICES OFFERED BY COOPERATIVES

Unprofitable Services
Seed Cleaning
Feed Mill
Feed Grinding and Delivery
Sprayer and Spreader Rental
Animal Health Products
Service Station Offering: tire repair tire sales oil changes wash jobs

able services was very strong. Seventy-five percent of smaller cooperatives committed to continuing unprofitable services also ranked service to membership as their first or second most important measure of success. Half of the cooperatives in the medium size groups expressing the need to offer services that do not break-even ranked service to membership as a top success measurement. Two-thirds of the large cooperatives had the same relationship.

The managers suggested many reasons for offering services that do not break-even. These are presented in Table V. They explained that even though the service does not support itself, it complements another phase of business which is profitable. Some managers justified the service since it was not available locally by another vendor. Some felt the service cost was countered by profit in another department. Some said it was such a minor part of the total operation that it was insignificant that it did not cover its own cost. Some managers explained that the unprofitable services were to be viewed as temporary due to loans and depreciation burdens. They went on to explain that in time these services were expected to become profitable.

Table VI shows various customer's comments and criticisms and how frequently they occurred. Managers were asked to rank these comments by how often they were expressed. Thus, the numbers in the table represent the

TABLE V

REASONS FOR OFFERING SERVICES THAT DO NOT BREAK EVEN

Reasons Offered
Complements Profitable Services
Not Available Locally
Minor Part of Total Operation
Temporarily Unprofitable

TABLE VI

NUMBER OF COOPERATIVES RECEIVING COMMENTS AND CRITICISMS FROM CUSTOMERS: RANKED BY FREQUENCY OF OCCURRENCE

	Ranked by Frequency of Occurrence				
	Most Frequent				Least Frequent
Comments and Criticisms	1	2	3	4	5
Cooperative's Input Prices Not Competitive	28	3	1		
Other Services Needed	2	11	10	1	2
Poor Employee Service	3	1	6	10	4
Poor Advice			2	9	10
Wheat Offers Not Competitive	3	10	5	5	1
Manager Not Available When Needed	1				
Small Patronage Dividend		1			

number of cooperatives receiving these types of criticisms and comments. The criticism occurring most frequently was that the cooperative input prices were not competitive. Other frequently occurring comments were: other services were needed but not provided by the cooperative, and wheat price offers were not competitive.

This last comment identifies a particular problem faced by cooperative grain elevators. Grain elevators that are not cooperative organizations often trade primarily grain and do not generally provide unprofitable services like cooperatives. Therefore, since much of the profitability is obtained from the margins on the grain trading, the elevators which are not cooperatives are in a more flexible position to raise wheat price offers enough to entice business away from cooperatives.

Many cooperatives indicated that less frequently occurring criticisms included poor employee service or poor advice. This would indicate that customers seem to have fewer complaints about personnel and more complaints concerning operational factors.

Board of Directors

Table VII contains general information about the board of directors. The average number of members on the board of directors was six members. For the small and large cooperatives the average age of the board

TABLE VII

BOARD OF DIRECTORS INFORMATION

Characteristic	All Cooperatives
Average Number of Members on Board	6 people
Pay Board Members to Attend Meetings:	
Small Cooperatives	57 percent
Medium Cooperatives	91 percent
Large Cooperatives	100 percent
Have a Junior Board of Directors:	
Small Cooperatives	0 percent
Medium Cooperatives	18 percent
Large Cooperatives	25 percent
Have Difficulty in Getting Members to Serve as Directors:	
Small Cooperatives	86 percent
Medium Cooperatives	45 percent
Large Cooperatives	38 percent

member was 50 years, while the medium size cooperative director on the average was 47 years.

All cooperatives surveyed had monthly board meetings. The smaller cooperatives had slightly stronger attendance compared to the medium and large cooperatives. Even though smaller cooperatives have higher attendance, they tend to pay their board members for attendance less often than the medium and large cooperatives. Fifty-seven percent of the small cooperatives paid their board members to attend meetings. Ninety-one percent of the medium size cooperatives paid board members to attend meetings and all large cooperatives used this incentive.

Forty-three percent of the small cooperatives had board members that attended educational or informational events that addressed their duties in the cooperative. They attended on the average two events in the past two years. Directors of medium and large cooperatives participated in more of these events with an average of five meetings in two years.

Twenty-five percent of large and 18 percent of medium size cooperatives have a junior board of directors. A junior board of directors participate in board meetings and events, but in most cooperatives do not have voting rights. This is one way used by some cooperatives to develop and train potential board

members. The experience gained on a junior board serves to develop seasoned decision makers for the cooperative.

Smaller cooperatives seem to have more trouble in getting members to serve as directors on their board than medium or large cooperatives. Eighty-six percent of the small cooperatives reported difficulty in getting members to serve as directors. Less than half of medium or large cooperatives reported difficulties. It should be noted that small cooperatives pay their directors less often for meeting attendance than medium or large cooperatives, which may be linked to the difficulty in getting members to serve on the board.

Management

On the average, cooperative managers in this study have been managers for 13 years. Small and medium cooperative managers average 12 years of experience but large cooperatives, on the average, have more experienced managers of about 17 years. Larger cooperative managers seem to stay in their job for longer time periods. According to this study, the current managers at the large cooperatives have been at the cooperatives an average of 11 years compared to the small cooperative's nine year average manager tenure and the medium cooperative's seven year average manager tenure. Managers previous experience as a foreman or assistant manager averaged five years of experience.

Table VIII shows current managers' plans for retirement from their present position. Almost half of these managers plan to retire within ten years. The smaller cooperatives in this study have more managers planning to retire within the next ten years (86 percent) than either of the other two size categories. Half of the large cooperatives in this study will lose their current manager to retirement within ten years. On the average, more of the medium size cooperative managers plan to stay with the cooperative longer than in the other two size groups.

Manager's formal education, consisting of trade school or college, was nearly two years on the average. Managers of large cooperatives had about one more year of formal education than managers of medium or small cooperatives. The managers surveyed attended an average of approximately 13 days at management classes, programs, and seminars in the last two years. The managers of medium size cooperatives average attendance was slightly higher with 14 days at events, while small cooperative managers attended less than the average by four days.

Manager salaries ranged between $15,000 and $54,000. The overall average was $31,496. The smaller cooperatives paid an average salary of $23,829. The average manager's salary in the medium size category was

TABLE VIII

RETIREMENT PLANS FROM PRESENT POSITION AS MANAGER

	Number of Managers			
		Retirement by Cooperative Size		
Plan to Retire	Total	Small	Medium	Large
Within 5 years	8	2	4	2
5 to 10 years	8	4	2	2
Beyond 10 years	20	1	15	4

$31,276, and in the large cooperatives the average salary was $38,812.

Approximately 30 percent of the cooperatives offered their managers some sort of management incentive. Fourteen percent of the small cooperatives surveyed offered a management incentive, while 27 percent of the medium size cooperatives offered management incentives, and half of the large cooperatives surveyed operated with incentives given to their managers.

These incentives took on various forms. Most respondent's incentives centered about net savings. Many received a percentage once a certain level of net savings was reached or increased. One cooperative reported the use of profit sharing. Another used net worth and net savings for the fiscal year as a regulator for their incentive program. One cooperative reported an additional retirement program was offered. Many of the bonuses had upper limits based on a percentage of the gross salary.

All but five percent of the cooperative managers surveyed reported the receipt of fringe benefits. On the average, the cooperatives paid 85 percent of hospitalization, 65 percent retirement and 74 percent life insurance and the manager paid the balance. Other fringe benefits offered to a few managers included disability insurance, dental insurance, savings plan,

uniforms, prepaid legal (family) fees, and cancer insurance.

Seventy-five percent of the large cooperatives employed an assistant manager, and the 25 percent that did not have one felt there was not a need for such a position in their cooperative. Only 14 percent of the medium size cooperatives had assistant managers, while 32 percent of medium size cooperatives not having an assistant manager felt there was a need in the cooperative for such a position. Surprisingly, 43 percent of the smaller cooperatives had assistant managers and 28 percent of the remaining cooperatives felt an assistant manager was needed in their cooperative. Overall, 32 percent of the cooperatives employed assistant managers and 32 percent of those not having an assistant manager felt a need in their cooperative for such a position.

Summary information about managers and employees is contained in Table IX.

Employees

On the average, the cooperative hired 10.50 full time employees and 4.50 part time employees. Small cooperatives used a higher mixed typed proportion of full and part time employees than the medium or the large cooperatives. Large cooperatives tend to hire more full time employees and only a few employees are hired part time.

TABLE IX

MANAGEMENT AND EMPLOYEE INFORMATION

General Information	Averages
Number of Years as Manager	13 Years
Previous Experience as a Foreman, Assistant Manager, or Bookkeeper	5 Years
Formal Education After High School	2 Years
Number of Days Per Year Spent at Management Seminars or Classes	13 Days
Salary Range	$15,000 - $54,000
Average Salary	$31,496
Number of Cooperatives Offering Management Incentives	30 Percent
Number of Cooperatives Offering Fringe Benefits	95 Percent
Cooperatives Employing Assistant Managers	32 Percent
Cooperatives Indicating Need for an Assistant Manager	32 Percent
Average Number of Full Time Employees	10.5 People
Average Number of Part Time Employees	4.5 People
Cooperatives Offering Employee Incentives	37 Percent

Over 37 percent of the cooperatives offered their employees some type of incentives. Twenty-nine percent of the small cooperatives, 32 percent of the medium sized cooperatives, and 63 percent of the large cooperatives offered incentives to their employees.

Goals and Objectives

Thirty percent of the cooperatives made written long term plans (three years or longer). Most cooperatives updated their plan annually although one cooperative reported a twice a year update. Fifty-seven percent of the small cooperatives, 27 percent of the medium cooperatives, and 25 percent of the large cooperatives made written long term plans implying long term plans are of greater priority for smaller cooperatives.

Table X contains summary information about cooperatives' written plans. Written operating plans (one year plan) were made by 38 percent of the cooperatives (57 percent small, 27 percent medium, 50 percent large). Interestingly enough these were not always the same cooperatives that made long term written plans, implying separate motivation for preparing the two different plans. Note that larger cooperatives put more emphasis on preparing a written operating plan as opposed to a written long term plan. Thirty-six percent of the cooperatives reviewed their operating plan every

TABLE X

WRITTEN BUSINESS PLAN INFORMATION

Characteristics	Percentages
Cooperatives with Written Long Term Plans	30 percent
By Size:	
Small	57 percent
Medium	27 percent
Large	25 percent
Cooperatives with Written Operating Plan	38 percent
By Size:	
Small	57 percent
Medium	27 percent
Large	50 percent
Frequency of Written Plan Review:	
Quarterly	36 percent
Every Four Months	7 percent
Semiannually	29 percent
Annually	29 percent

three months, 7 percent of the cooperatives updated their plan once every four months, 29 percent of the cooperatives reviewed their plan twice a year, and 29 percent of the cooperatives reviewed their plan once a year.

Managers were asked to rank in order of importance (one being most important) the following factors they used in measuring success for their cooperative elevator: growth in trade, net savings after taxes, patronage refund in cash reimbursement, return on assets, return on equity, service to membership, volume, and other (the cooperative specified).[3] The body of Table XI shows the number of cooperatives that responded to using the various success measurements and each measurement's importance shown through rank. Tables XII - XIV show similar information for the three size groups of cooperatives in this study. From the overall picture in Table XI, we see that two success factors, net savings and service to membership, were ranked most important for measuring success by the cooperatives. Seven cooperatives ranked these two factors, net savings and service to membership, as equally important as a measurement of success. This implies more than one criteria for success is necessary for these decision makers. Four of those cooperatives giving the same ranking to two success factors were in the medium size

TABLE XI

FREQUENCY OF RANKED FACTORS USED AS MEASUREMENTS OF SUCCESS BY ALL COOPERATIVES

Factors Used As Measurements Of Success By Cooperatives	Frequency Of Ranking Of Success Factors * (Ranked by Cooperatives in order of importance)							
	MOST IMPORTANT 1	2	3	4	5	6	7	LEAST IMPORTANT 8
Growth In Trade	2	9	3	5	4	7	2	1
Net Savings	18	5	5	2		2		
Patronage Refund (Cash)	2	2	5	3	7	4	9	
Return On Assets	1	10	9	5	3	4	1	
Return On Equity	1	3	7	5	10	4	1	
Service To Membership	22	2	5	2	4	1	1	
Volume	1	1	8	4	2	6	10	
Other:								
Trust Of Membership	1							
Debt To Equity		1						
Attitude Towards Cooperatives			1					

* Some cooperatives gave the same ranking to more than one success measurement.

TABLE XII

FREQUENCY OF RANKED FACTORS USED AS MEASUREMENTS OF SUCCESS BY SEVEN SMALL COOPERATIVES

Factors Used As Measurements Of Success By Cooperatives	Frequency Of Ranking Of Success Factors * (Ranked By Cooperatives In Order Of Importance)							
	MOST IMPORTANT 1	2	3	4	5	6	7	LEAST IMPORTANT 8
Growth In Trade	1	4		1				
Net Savings	4	1						
Patronage Refund (Cash)				1	1	2		
Return On Assets		1	1	1	1			
Return On Equity				1	3	1		
Service To Membership	2	2	1	1			1	
Volume			1	1			3	

* Some cooperatives gave the same ranking to more than one success measurement.

TABLE XIII

FREQUENCY OF RANKED FACTORS USED AS MEASUREMENTS OF SUCCESS BY 22 MEDIUM COOPERATIVES

Factors Used As Measurements Of Success By Cooperatives	Frequency Of Ranking Of Success Factors * (Ranked By Cooperatives In Order Of Importance)							
	MOST IMPORTANT 1	2	3	4	5	6	7	LEAST IMPORTANT 8
Growth In Trade	1	2	3	3	3	5	2	1
Net Savings	9	3	5	2		1		
Patronage Refund (Cash)	2	2	3	1	3	2	7	
Return On Assets		7	5	3	2	3	1	
Return On Equity	1	2	5	2	7	2		1
Service To Membership	14		3	1	3	1		
Volume	1	1	6	3		4	5	
Other:								
Trust Of Membership	1							
Debt To Equity		1						
Attitude Towards Cooperatives			1					

* Some cooperatives gave the same ranking to more than one success measurement.

TABLE XIV

FREQUENCY OF RANKED FACTORS USED AS MEASUREMENTS OF SUCCESS BY EIGHT LARGE COOPERATIVES

Factors Used As Measurements Of Success By Cooperatives	Frequency Of Ranking Of Success Factors * (Ranked By Cooperatives In Order Of Importance)							
	MOST IMPORTANT 1	2	3	4	5	6	7	LEAST IMPORTANT 8
Growth In Trade		3		1	1	2		
Net Savings	5	1				1		
Patronage Refund (Cash)			2	1	3		2	
Return On Assets	1	2	3	1		1		
Return On Equity		1	2	2		1	1	
Service To Membership	6		1		1			
Volume			1		2	2	2	

* Some cooperatives gave the same ranking to more than one success measurement.

category and the remaining three cooperatives were large cooperatives.

Tables XIII and XIV show that both medium and large cooperatives ranked service to membership as a more most important measure of success than net savings. The opposite can be seen in Table XII for the small cooperatives. This may imply that continued existence to small cooperatives is of higher concern than the other size categories who may be in a better position to benefit from economies of size.

Return on assets, growth in trade, and return on equity seemed to be secondary in consideration but, nevertheless, important success measurements for all size categories. As can be seen in Table XI, all success measurements listed were chosen by at least one cooperative as their most important success measurement.

Cooperatives that chose service to membership as their first or second measure of success possessed some interesting characteristics. Over half of them offer volume discounts to their membership. They often offer services that do not break-even and feel less inclined to discontinue unprofitable services when a membership need is being met. They do relatively more training of junior boards of directors and feel strongly about its potential to train well seasoned decision makers. They seem to have less difficulty in getting members to serve on the board of directors compared to other cooperatives

whose priority goals are other than service to membership. Over a third of the cooperatives offer their manager and employees some sort of incentive plan.

Cooperatives choosing net savings as their success goal tend to feel stronger about discontinuing unprofitable services. More than half of them have branch elevators and over 75 percent of them offer volume discounts to their members. They tend to have higher than the average number of competitors and express some difficulty in getting members to serve on the board of directors. These cooperatives also recognize the benefit of training a junior board of directors, but fewer of them pay their board members for meeting attendance. More of these cooperatives tend to publish newsletters and write operating plans.

Strategies

Managers were asked to report the type of marketing alternatives they used for selling their 1985 grain. On the average, 87 percent of the total volume traded was sold back to back.[4] Eleven percent of the cooperatives reported that they hedged grain and eight percent reported that they used an unprotected strategy to market their grain.[5] The strategy of using a wheat pool was not reported as a marketing alternative by the respondents. Eleven percent of the cooperatives put grain into government loan programs. Table XV shows the

TABLE XV

NUMBER OF COOPERATIVES USING VARIOUS MARKETING ALTERNATIVES

	Number of Cooperatives			
Marketing Alternatives	Total	Small	Medium	Large
Back to Back	37	7	22	8
Hedged	4	0	4	0
Unprotected	3	0	1	2
Government Loan	4	1	3	0

number of cooperatives by size category using the various types of marketing alternatives.

Sixty percent of the cooperative respondents offered their members volume discount on input purchases.[6] Seventy-five percent of the medium size cooperatives offered volume discounts, while 43 percent of the small cooperatives and 38 percent of the large cooperatives made the same offer to their membership.

Financial Aspects

Ninety-two percent of the cooperatives grouped their financial records by departments such as feed mill operation, animal health products, petroleum and fertilizer services. Those that did not group their financial records were small and medium size cooperatives.

Eighty-nine percent of the cooperatives evaluated their financial records on a monthly basis. The remaining cooperatives used a quarterly evaluation.

Medium size cooperatives seemed to be most dependent on regional patronage refund since 77 percent of net savings was from this source of funds.[7] Small cooperatives relied on the regional patronage dividend for 72 percent of their net savings as seen in Table XVI. The large cooperatives received 50 percent of net savings from this same source, implying more self reliance in terms of profitability.

TABLE XVI

SOURCE OF TOTAL NET SAVINGS AFTER TAXES

Source	Small	Medium	Large
Percent From:			
Local Net Savings	28	23	50
Regional Patronage Refund	72	77	50

Tables XVII - XIX contain comparisons of financial ratios categorized into four groups: profitability, leverage, liquidity, and asset management. Three time scenarios were used to evaluate these ratios. Five year averages were used for the data from 1981 through 1985. Three year averages included 1983 through 1985. Ratios were also calculated from 1985 data. Table XVII contains ratios for 5 year average data, Table XVIII contains ratios for three year average data, and Table XIX contains 1985 average ratios. Profitability and leverage ratios are expressed in percentages.

Profitability

In the profitability ratios, there is a distinction made between return on assets or equity and local return on assets or equity. Return on assets and return on equity both are calculated using total net savings received by the cooperative which includes patronage dividends from regional cooperative membership. Local measures do not include regional patronage dividends received, thus local ratios are measures reflecting more cooperative self-reliance.

Return on assets expresses net savings after taxes as a percentage of total assets. Local return on assets differs from return on assets in the numerator of the ratio calculation. Local net savings after taxes is the difference between net savings after taxes and patronage

TABLE XVII

COMPARATIVE FINANCIAL RATIOS, FIVE YEAR AVERAGES

Financial Ratios	Total	Small	Medium	Large
Profitability: (Percentages)				
Return On Assets	5.7	4.9	5.4	7.3
Local Return On Assets	1.8	1.0	1.3	3.6
Return On Equity	7.6	7.2	6.8	9.9
Local Return On Equity	1.4	0.7	0.7	3.9
Leverage: (Percentages)				
Debt To Asset	32.7	35.9	31.3	33.7
Debt To Equity	57.1	62.6	53.5	62.3
Liquidity:				
Current Ratio	2.233	2.181	2.327	2.019
Asset Management:				
Total Asset Turnover	2.170	2.518	2.143	1.940

TABLE XVIII

COMPARATIVE FINANCIAL RATIOS, THREE YEAR AVERAGES

Financial Ratios	Total	Small	Medium	Large
Profitability: (Percentages)				
Return On Assets	3.8	2.1	3.7	5.4
Local Return On Assets	0.9	-0.8	0.7	2.8
Return On Equity	4.3	2.2	4.2	6.6
Local Return On Equity	0.0	-2.3	-0.2	2.5
Leverage: (Percentages)				
Debt To Asset	30.7	34.5	29.4	31.1
Debt To Equity	52.0	59.6	49.2	52.9
Liquidity:				
Current Ratio	2.427	2.376	2.560	2.105
Asset Management:				
Total Asset Turnover	2.019	2.276	2.016	1.800

TABLE XIX

COMPARATIVE FINANCIAL RATIOS, 1985 DATA

Financial Ratios	Total	Small	Medium	Large
Profitability: (Percentages)				
Return On Assets	3.3	1.8	3.6	3.9
Local Return On Assets	0.1	-1.2	0.2	1.1
Return On Equity	3.8	2.3	4.2	4.0
Local Return On Equity	-0.9	-2.5	-0.7	0.0
Leverage: (Percentages)				
Debt To Asset	29.3	32.5	28.2	29.7
Debt To Equity	48.9	54.4	46.9	49.9
Liquidity:				
Current Ratio	2.547	2.442	2.658	4.336
Asset Management:				
Total Asset Turnover	1.871	1.993	1.924	1.618

dividends the local cooperative receives from membership in a regional cooperative. Therefore, local returns to assets are consistently and considerably lower than returns including regional patronage dividends since 50 to 77 percent of net savings after taxes are regional patronage dividends. Equations 3.1 and 3.2 are the mathematical expression used for these two ratios.

(3.1)

$$\text{Return on Assets} = \frac{\text{Net Savings After Taxes}}{\text{Total Assets}} * 100$$

$$\text{Local Return on Assets} = \frac{\text{Local Net Savings After Taxes}}{\text{Total Assets}} * 100 \qquad (3.2)$$

The five year average data in Table XVII shows large cooperatives receiving the highest return on assets (7.3 percent) and local return on assets (3.6 percent). The medium size cooperatives had the next highest returns followed by the small cooperatives. This could be attributed to the benefits of economies of size gained as firm size increases.

The same pattern follows for the three year average ratios and the 1985 average ratios shown in Tables XVIII and XIX, respectively. Small cooperative local returns on assets were negative in the 3 year and 1985 average ratios (-0.8 and -1.2, respectively).

Return on equity, another profitability measure, expresses net savings as a percent of members equity. This measure represents the level of earnings associated with members investment. Mathematical equations for the computations used are expressed in Equations 3.3 and 3.4.

(3.3)

$$\text{Return on Equity} = \frac{\text{Net Savings After Taxes}}{\text{Total Member Equity}} * 100$$

Local Return on Equity =

$$\frac{\text{Local Net Savings After Taxes}}{\text{Total Member Equity}} * 100 \qquad (3.4)$$

For the three year average ratios, Table XVIII shows returns and local returns on equity follow a pattern from highest to lowest return for large to medium to small cooperatives, respectively. However, in the five year average ratios, the highest return on equity going to large cooperatives (9.9 percent) was followed by small cooperatives (7.2 percent) and then by medium size cooperatives (6.8 percent). Local returns on to equity in the five year data shows large cooperatives receiving the most return (3.9 percent) while small and medium cooperatives were returning an equal amount of equity (0.7 percent).

The 1985 ratios have a different pattern for returns. Medium cooperatives had the highest return on

equity (4.2 percent) followed by large and then small cooperatives. However, as shown in Table XIX, local return on equity was highest for large cooperatives, followed by medium and small cooperatives. Local returns on equity were positive for the five year average ratios, and one of the three years average ratios. All other local returns on equity were negative.

Leverage

Two leverage measures are presented in Tables XVII - XIX: Debt to Asset and Debt to Equity.[8] The debt to asset ratio is expressed in equation form in 3.5. This measure expresses total liabilities as a percentage of total assets.

$$\text{Debt to Assets} = \frac{\text{Total Liabilities}}{\text{Total Assets}} * 100 \qquad (3.5)$$

$$\text{Debt to Equity} = \frac{\text{Total Liabilities}}{\text{Total Member Equity}} * 100 \qquad (3.6)$$

As seen in Equation 3.6, debt to equity measures the total liabilities as a percentage of total member equity.

In all three time scenarios, the medium size cooperatives had the lowest debt to asset ratio in

comparison, followed by large and then small cooperatives. This means that medium cooperatives are using less borrowed money to finance their operation and growth than the other two size categories. The same pattern persists for the debt to equity ratio; medium cooperatives had the lowest debt to equity ratio followed by large and then small cooperatives.

Liquidity

The current ratio is a measure of liquidity. Liquidity is the ability to meet short-term financial obligations. As seen in Equation 3.7, the current ratio is computed by dividing current assets by current liabilities.

$$\text{Current Ratio} = \frac{\text{Current Assets}}{\text{Current Liabilities}} * 100 \qquad (3.7)$$

The five year average in Table XVII shows that 2.3 times as much current assets exist for each dollar of current liability for medium size cooperatives. The next largest current ratio, 2.18, is for the small cooperatives, followed by a current ratio of 2.0 for the large cooperatives. This pattern from highest to lowest for medium, small and large cooperatives is consistent among the other two time scenarios. This indicates that medium size cooperatives are in a better position to pay their current bills as they come due than the other two

size groups. This could be due to the medium cooperatives having a lower degree of leverage. That is, less money is going into paying debt and more is available to meet short term obligations.

Asset Management

The total asset turnover ratio is a measure of asset management or activity. This ratio divides the volume of sales by total assets. It is a measure of the turnover or utilization of all the business's assets. The ratio is expressed in Equation 3.8.

$$\text{Total Asset Turnover} = \frac{\text{Sales}}{\text{Total Assets}} \qquad (3.8)$$

For all three time scenarios, the small cooperatives have the highest total asset turnover (2.5 for the five year average, 2.2 for the three year average, and 1.9 for the 1985 ratio). This is followed by the medium and then the large cooperatives as seen in Tables XVII - XIX. This indicates for the cooperatives surveyed, that as the size of the business gets larger its asset management becomes less efficient.

In Figure 2, we see return on assets for the years 1981-1985 for all cooperatives and by size breakdown. While all experience a downward trend, we see smaller cooperatives experience more dramatic changes and decline than the other groups. When compared to

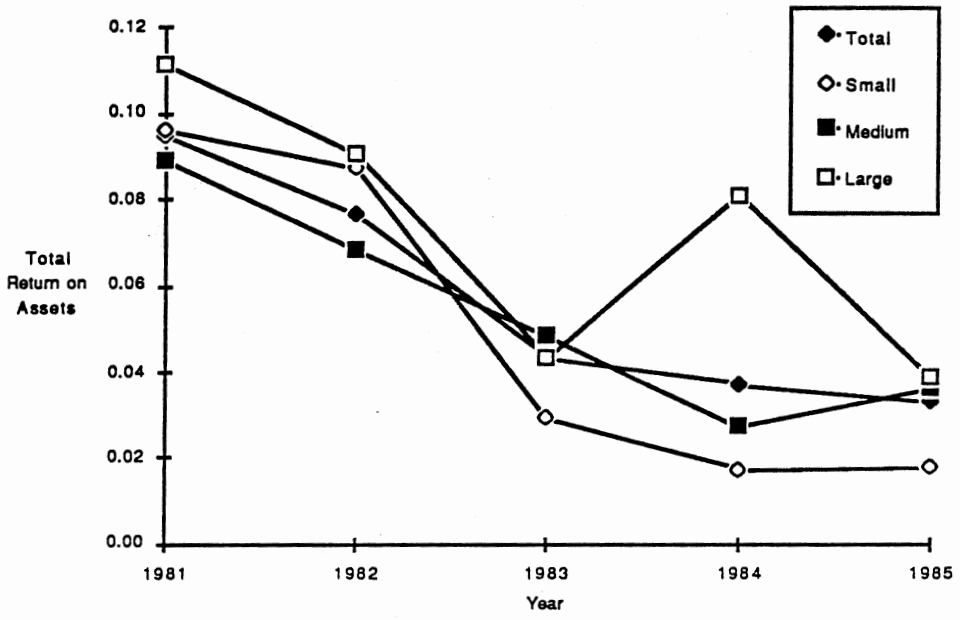

Figure 2. Total Return on Assets, 1981-1985

Figure 3, demonstrating local returns on assets, we see the same kind of downward movement. In 1981, large cooperatives had a local return on assets of five percent and a total return on assets of 11 percent. Therefore, more than half of the total return on assets consisted of the regional patronage dividend contribution. However, in 1984, we see a two percent decrease in margin between the five percent for local and nine percent for overall return on assets, indicating a decrease in dependency on earnings from regional cooperatives and more reliance on earnings made at the local level.

Movement towards more self-reliance is an important direction for cooperatives. The majority of the regional patronage dividends for cooperatives surveyed come from two sources: Farmland Industries and Union Equity, a large grain cooperative made up of membership by local cooperatives. If one of these regional cooperatives suffers some major losses, then local cooperatives with major dependency on this cooperative stand to experience major repercussions.

It should be noted how volume plays a connecting role for total and local profits. Volume traded through the local cooperative effects the total net savings of the cooperative through its regional patronage refund. The volume traded at the local cooperative is sold to the regional cooperative of which

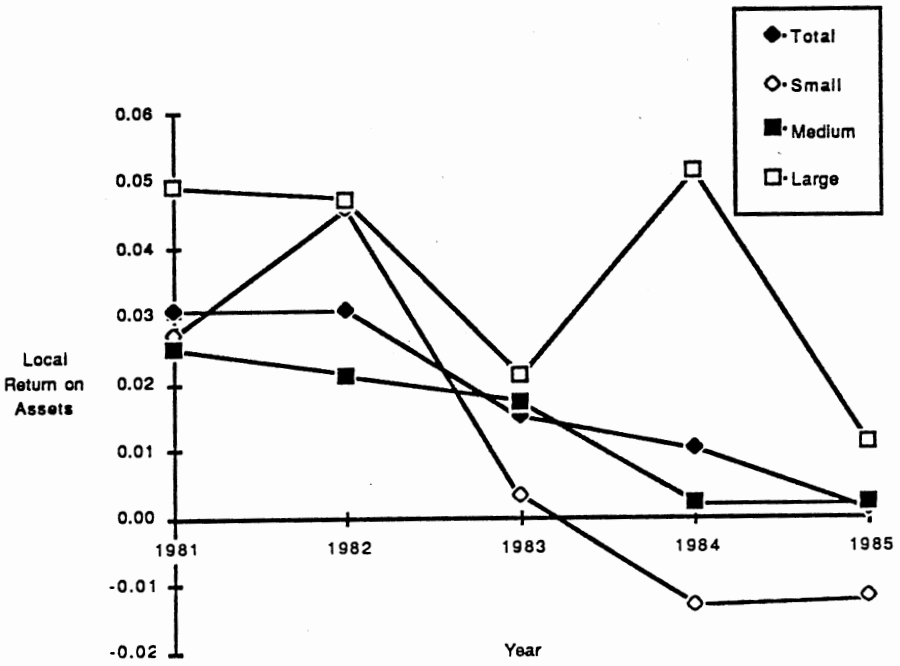

Figure 3. Local Return on Assets, 1981-1985

the local cooperative is a member-owner. The regional patronage refund returned to the local cooperative is based on the amount of business or patronage the local has done with the regional cooperative. Therefore, local volume sold to the regional cooperative determines the proportion of patronage return the local cooperative receives. The more volume traded through a local cooperative and sold to the regional cooperative, the higher will be the regional patronage refund. Thus, the total return the cooperative receives is higher.

While regional partonage dividends influenced by local volume traded is a positive aspect, the problem arises when local cooperatives depend on these funds to counter high proportions of unprofitable services in their local cooperative. Therefore, local cooperatives who benefit from regional patronage refunds while not depending heavily on these funds to offset large losses on the local level are in better competitive positions.

Figure 4 shows the debt to equity for all cooperatives and by size category. The general trend is a downward decline indicating cooperatives are reducing their debt or total liabilities in proportion to their member equity. The only exception is small cooperatives whose debt to equity ratio increased in 1984 but dropped again in 1985. Small cooperatives' debt increased in 1984, which may be a result of having to absorb more credit by farmers due to the economic situation.

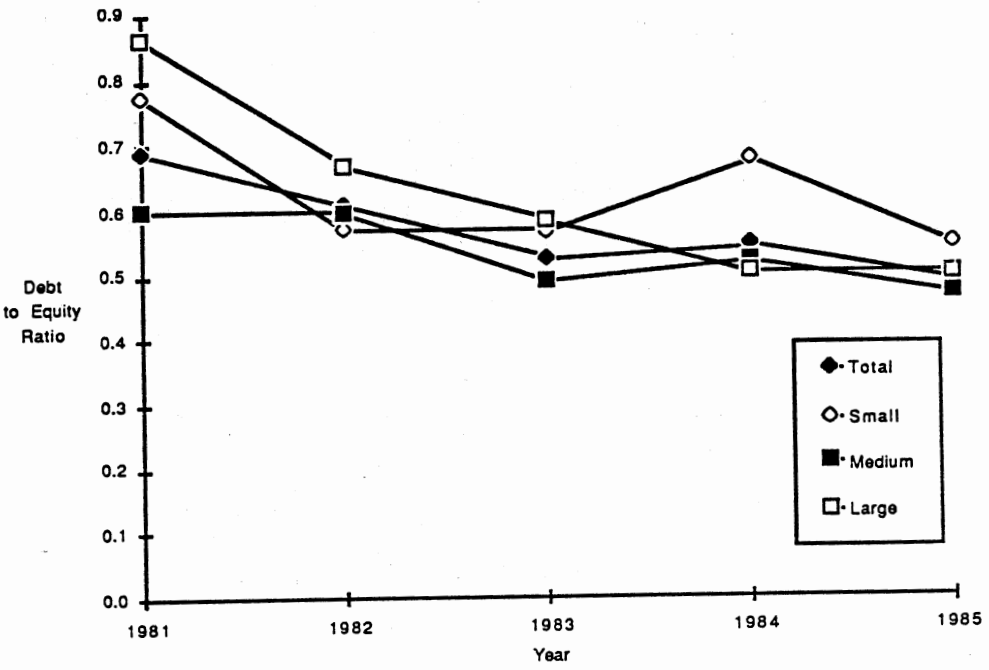

Figure 4. Total Debt to Equity, 1981-1985

There is an upward trend from 1981-1985 in the current ratio for the cooperatives as seen in Figure 5. Once again we see more volatility in the small and large cooperatives, but even these cooperatives' overall trend is upward. Since the current ratio represents the firm's ability to generate enough cash to pay its bills and expenses on time, the upward trend signifies cooperatives are now in better financial positions to meet these obligations than in preceding years.

Challenges

The managers were asked to list the most important problems facing their cooperatives. There was a wide variety of responses, but they seem to fall into two categories, external and internal problems. A summary is presented in Table XX.

External problems were heavily influenced by the depressed economic state of agriculture. High interest rates, along with high input and low output prices have brought about a decline in income to conventional farmers.[9] This decline in income has resulted in cash flow problems for many farmers, which in turn has affected their ability to pay bills at the cooperative. Bankruptcy of farmers has left some cooperatives with bad debts to absorb.

Another external problem is the increasing cost of operation of the cooperative facilities. Some managers

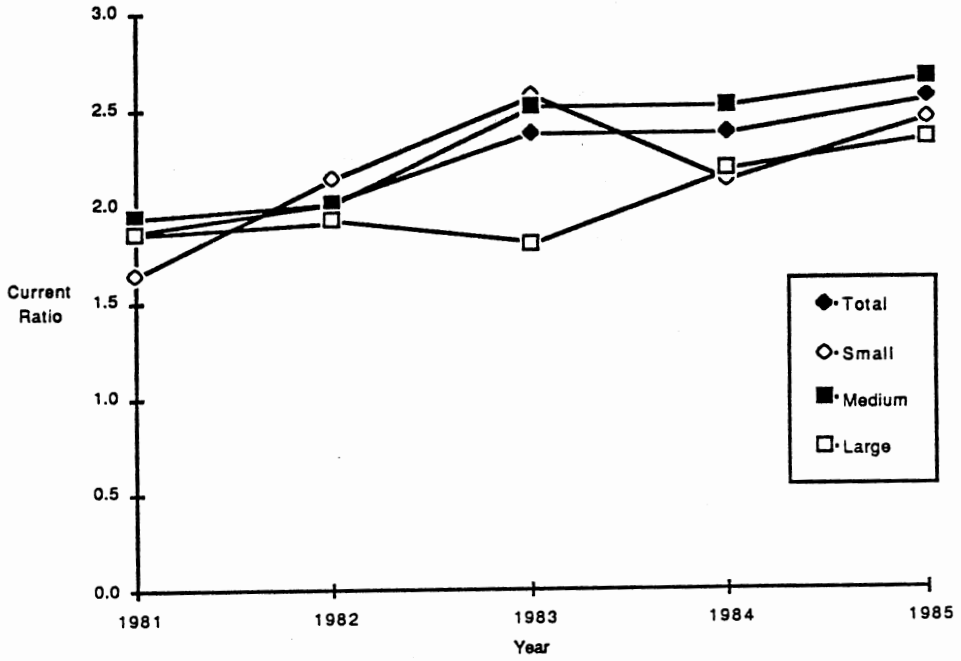

Figure 5. Current Ratio, 1981-1985

TABLE XX

PROBLEMS THAT CHALLENGE COOPERATIVES

Problems Cooperatives Face
External Problems:
Economic
Decline in Income
Cash Flow Problems
Changing Agriculture Structure
Fewer Farmers
Larger Farm Size
Railroad Abandonment
Internal Problems:
Unprofitable Services
Inadequate Margins for Local Profit
Capital Stock Retirement

reported that costs for electricity and natural gas were increasing. Others expressed difficulty in maintaining adequate facilities or replacing older facilities to give proper service.

Managers also saw the government's surplus of grain as a problem. They mentioned that many farm programs were not understood by farmers and caused increasing problems since these programs were always changing and not consistent.

Another problem is the railroad's abandonment of lines to branch elevator facilities. This causes a transportation problem, particularly to medium size cooperatives who rely heavily on the use of the railroads as a transportation method. This situation creates problems since they need the volume to be competitive.

Managers reported some of the problems were directly associated with the membership's behavior. Many members failed to make changes when necessary. Some of the young farmers were considered too self-centered in attitude in that they want all the benefits of the cooperative without any responsibility. Part of the loss of patrons was due to the change in the agricultural structure. Fewer farms exist, but these farms tend to be larger in size and therefore are in less need of the cooperative. Because of their economies of size, they have increased bargaining power

allowing them to seek volume discounts and trade elsewhere.

Internal problems revolved around the cooperatives' need to make changes. Many managers saw the need for obtaining local profits without reliance on regional patronage dividends. This is especially important since many cooperatives receive at least half of their net savings from this source. To ensure local profit they expressed a need for adequate margins. The unprofitable services rely on subsidization from the margins made on grain trade, therefore, many managers saw this as a burden. Many cooperatives also lack a competitive edge in sales of fertilizer and farm supplies.

Local policy concerning stock retirement and accounts receivable were also mentioned. Managers state that the stock needs to be owned by active members. Many cooperative's stock ownership is in the possession of deceased or retired members no longer using the cooperative or by members who have moved away from the community. Accounts receivable and credit policies in cooperatives have been adversely affected by the farmers' cash flow problems and inability to pay debts.

Some managers have expressed an inability to provide services needed by the cooperative membership. Obtaining quality employees to enhance customer service was another difficulty mentioned. Some expressed a conflict with the difference in treatment of large and

small farmers and felt this was a violation of the cooperative principle of equal treatment.

Many managers were concerned about the apathy of the membership towards their cooperative. They expressed a need to educate members to try to regain their confidence, increase their understanding, and change their attitude towards a loyal and supportive involvement. The education process should include development of younger farmers as potential leaders in the cooperative movement.

Many managers wanted to expand their trade area and/or regain market share. The smaller cooperatives experienced lack of buying power. Some managers felt competition with other cooperatives was a problem and others experienced unfair competition from independents.

ENDNOTES

[1]The sample consisted of 37 cooperatives in Oklahoma with one of those cooperatives being located on the Texas-Oklahoma border.

[2]The author wishes to thank Dr. David Park for use of a portion of the raw financial data used in this study and for his help in providing contacts for additional financial data necessary.

[3]The measures of success listed on the questionnaire come from information obtained in personal contact with some mangers and from the literature. The managers were asked to rank only those criteria they used and were given the opportunity to write in any other success measurements used.

[4]Back to back is the term used to describe the process of a cooperative finding a place to sell the grain as soon as purchased and then making the transaction immediately.

[5]Unprotected grain marketing occurs when the cooperative retains a certain amount of grain throughout the year for speculating on a higher return to be gained at a later date in the fiscal year.

[6]For large volume purchases, members pay a lower price per unit for the desired product. This strategy is used by some cooperatives to compete with other suppliers. It is aimed at keeping larger farmers' memberships, since they could obtain similar treatment from an independent.

[7]In this study, net savings after taxes is made up of two components, local net savings and patronage refund from regional cooperatives of which the local cooperative is a member-owner.

[8]Leverage is the extent to which a business uses borrowed money to finance its operation or growth.

[9]Conventional farming is capital intensive, with heavy reliance on purchased fertilizer and chemical inputs.

CHAPTER IV

DESCRIPTION OF PROCEDURES AND DATA

This study explores the relationship between two sets of variables: a set of success measurements (criterion variables) and a set of managerial and financial factors (explanatory variables). Kachigan (1982) states that there is no one analysis that is most appropriate for understanding a criterion variable, but rather the greatest understanding is most likely to result from a number of alternative analyses, each viewing the problem from a different angle.

Three alternative analyses are used in this study. Correlation analysis, regression analysis, and canonical correlation analysis are used to derive a clearer understanding of the data. Each approach is a generalization of the other methods. Correlation analysis explores the relationship between two variables. Regression analysis explores the relationship between one criterion variable and a set of explanatory variables. Canonical correlation analysis explores the relationship between a set of criterion variables and a set of explanatory variables. Each method of analysis

is discussed independently. Data used in this study is discussed at the end of this chapter.

Description of Statistical Methods

The statistical methods used for this study are described independently in this section beginning with correlation analysis, followed by regression analysis and canonical correlation analysis.

Correlation analysis

Correlation analysis is an assessment of the linear association which exists among two random variables. Thus, it can be used to observe how different pairs of variables covary.

The level of association in correlation analysis is determined by computing the sample correlation coefficient (r) given the set of observed values for each of two random variables X and Y. The sample correlation coefficient is calculated as shown in Equation 4.1.

$$r = \frac{\sum (x_j - \bar{x})(y_j - \bar{y})}{(n - 1)\, S_x S_y} \qquad (4.1)$$

where,

$x_j - \bar{x}$ is the difference between the individual x measurements, (x_j), and the sample mean of the x's ($\bar{x}$);

$y_j - \bar{y}$ is the difference between the individual y measurement, (y_j), and the sample mean of the y's, $(\bar{y})$;

n - 1 is the number of observations minus one; and

S_x and S_y are the sample standard deviations of x and y, respectively, such that:

$$S_x^2 = \sum (x_j - \bar{x})^2/(n-1) \text{ and}$$

$$S_y^2 = \sum (y_j - \bar{y})^2/(n-1).$$

The correlation coefficient r is interpreted as follows. If r=1, then there exists a perfect positive linear relationship. If r=-1, then a perfect negative linear relationship exits. If r=0, no apparent linear relationship exists between the observed variables. A high correlation between two variables does not necessarily imply a cause and effect relationship between these variables, but one may be present.

Correlation analysis in this study is used as an exploratory tool to determine the linear relationship that exists between pairs of criterion variables, between pairs of criterion and explanatory variables, and between pairs of explanatory variables.

Regression Analysis

Whereas correlation analysis provides us with a linear relationship between only two variables, regression analysis investigates the relationship between a single variable with a set of variables usually expressed in equation form.

In general, the objectives of regression analysis can be summarized as follows: (1) to determine whether or not a relationship exists between one variable and a set of variables, (2) to describe the nature of the relationship, should one exist, (i.e. a possible cause and effect among variables and the direction of that causal effect) in the form of a mathematical equation, and (3) to assess the degree of accuracy of description or prediction achieved by the regression equation (Kachigan, 1982).

In regression analysis, the values of the explanatory variables are used to estimate the mean value of a single criterion variable. This is accomplished by using a linear function to represent the best-fit of all lines, or planes in multiple regression, passing through the data points. The criteria most used for choosing the best-fitting line is the least-squares criterion. Of all possible lines, the least-squares criterion chooses the line with the smallest sum of squared deviations of the data points from the fitted line.

The multiple regression model is expressed mathematically in Equation 4.2.

$$Y_t = B_0 + B_1X_{t1} + B_2X_{t2} + \ldots + B_kX_{tk} + e_t \quad (4.2)$$

where,

Y_t is the t^{th} observation of the criterion variable;

B_0 is an intercept term;

B_j, j=1 to k, are the true and unknown coefficients that relate the explanatory variables to the criterion variables;

X_{tj}, t=1 to n, j=1 to k, are the explanatory variables;

e_t is the unknown stochastic (random) disturbance for the t^{th} observation;

k is the number of parameters in the model; and

n is the number of total observations.

Given this model, the ordinary least-squares technique (OLS) finds the estimate for the B_j's that minimizes the sum of square residuals when B_j is replaced by the estimated B_j (or $\hat{B}_j$) and used with the corresponding explanatory variables (X_j) to estimate Y.

In order to obtain desirable results certain assumptions must be satisfied. They are as follows:

(1) The expected value (or mean) of the disturbance (e_t) is zero.

(2) The disturbances have a common or identical variance and the disturbances are not autocorrelated.

(3) The explanatory variables are uncorrelated with the disturbance term.

(4) The explanatory variables have fixed values in repeated samples.

(5) The explanatory variables are linearly independent.

(6) There must be more observations than independent variables.

In a case where there is a single criterion variable and many explanatory variables, there may exist the desire to determine the best subset of these explanatory variables and the corresponding best-fitting regression model for describing the relationship between the criterion and explanatory variables. Four basic statistical procedures can be used: (1) the all-possible-regression procedure, (2) the backward elimination procedure, (3) the forward selection procedure, and (4) the stepwise regression procedure (Kleinbaum and Kupper, 1978). Since the all-possible-regression procedure is not practical and the stepwise procedure is a combination of forward selection and backward elimination procedures, stepwise regression is used in this study. The stepwise procedure is discussed below, but further explanation of the other methods mentioned above can be found in Kleinbaum and Kupper (1978).

The stepwise procedure works in the following way. It begins by choosing the explanatory variable that accounts for most of the variance in the criterion variable. One at a time, the technique adds other variables

which account for most of the remaining or residual unexplained variance. Explanatory variables are continually introduced until the resulting increase in R^2 becomes insignificant. This procedure also permits reexamination, at every step, of the variables already incorporated in the model in previous steps. A variable that entered the model in an earlier stage may now be inappropriate due to its relationship with other variables that have most recently entered the model. Kleinbaum and Kupper (1978) explain that this is done at each step by checking the partial F-test for each variable presently in the model, treating it as though it were the most recent variable entered, irrespective of its actual entry point into the model. The variable with the smallest nonsignificant partial F-statistic, should one exist, is removed. The model is then refitted with the remaining variables, the partial F's are obtained and again examined, and the process continues until no more variables can be entered or removed.

The partial F-statistic previously discussed is presented in mathematical form in Equation 4.3. Suppose there are k explanatory variables in the model. To test the significance of the d^{th} variable of the set of k variables, the partial F-statistic is given by:

$$F_d = \frac{MSR(X_d \mid x_1, x_2, \ldots, x_{d-1}, x_{d+1}, \ldots, x_k)}{SSE(x_1, x_2, \ldots, x_k)/(t - (k + 1))} \quad (4.3)$$

where,

$MSR(X_d \mid x_1, x_2, \ldots, x_{d-1}, x_{d+1}, \ldots, x_k) =$

$SSE(x_1, x_2, \ldots, x_{d-1}, x_{d+1}, \ldots, x_k) - SSE(x_1, x_2, \ldots, x_k)$;

$SSE(x_1, x_2, \ldots, x_k)$ is the error sum of squares after fitting the model with all k variables in the model;

$SSE(x_1, x_2, \ldots, x_{d-1}, x_{d+1}, \ldots, x_k)$ is the error sum of squares after fitting the model with the d^{th} variable removed;

t is the number of total observations; and,

k is the number of explanatory variables in the model.

Canonical Correlation Analysis

Many times the social scientist encounters a situation that is best described not in terms of a single criterion variable but, because of its complexity, in terms of a set of criterion variables. An approach to study the relationship between a set of criterion variables and a set of explanatory variables is known as canonical correlation analysis.

Canonical correlation analysis is a more general approach in analyzing data than multiple regression (Tabachnick and Fidell, 1983). In multiple regression, a distinction is made between criterion and explanatory variables. In canonical correlation analysis, this

distinction is not necessary. However, in this study, this distinction is made for clarification and consistency.

Canonical correlation analysis maximizes the correlation between the linear combination of one set of variables and the linear combination of the other set of variables. These linear combinations are known as canonical variates. The value of the maximized correlation between the linear combinations is the canonical correlation.

The first pair of canonical variates derived exhibits the highest intercorrelation between the two sets of variables. A second pair of canonical variates is then derived, maximizing the correlation between the linear combination of variables after the variance due to the first pair of canonical variates has been removed. This second pair of canonical variates is uncorrelated with the first pair. Calculation of pairs of canonical variates continues in this manner until no significant linkages between sets remain in the residual correlation matrix or until as many pairs of canonical variates have been defined as there are variables in the smaller set. Thus, the first pair of canonical variates exhibits the highest correlation, the second pair the next largest correlation, and so forth.

The canonical variates are derived through the use of canonical weights. The canonical weights trans-

form the original variables so that the correlation between the explanatory and criterion sets of variables is maximized. The magnitude of the weight tells us the importance of a variable from one set with regard to the other set in obtaining a maximum correlation between the sets.

The canonical correlation and canonical weights are obtained by solving the following equation:

$$(R_{12}R_{22}^{-1}R_{21} - \lambda_k R_{11})W_k = 0 \qquad (4.4)$$

where,

R_{12} and R_{21}, respectively, are the txd and dxt sample cross-correlation matrices between the t criterion and the d explanatory variables;

R_{11} is the txt sample correlation matrix for the criterion variables;

R_{22} is the dxd sample correlation matrix for the explanatory variables;

λ_k is the squared canonical correlation for the k^{th} pair of canonical variates (also called the canonical root or the canonical R^2); and

W_k is the tx1 vector of weights, w_{kj}, for the t criterion variables associated with the k^{th} pair of canonical variates where w_{kj} is the canonical weight for the j^{th} criterion variable, with j = 1 to t.

The dx1 vector of canonical weights, v_{kj}, for the d

explanatory variables associated with the k^{th} pair of canonical variates where v_{kj} is the canonical weight for the j^{th} explanatory variable, with j = 1 to d, is

$$V_k = (1/(\lambda_k)^{1/2})R_{22}^{-1}R_{21}W_k. \qquad (4.5)$$

Note that $(\lambda_k)^{1/2}$ is the canonical correlation for the k^{th} canonical pair of variates.

The canonical variates are calculated as linear combinations of the original variables as shown in Equation 4.6 and 4.7. The k^{th} canonical variate for the criterion variables is

$$G_k = \sum w_{kj}Y_j \qquad (4.6)$$

where,

Y_j is the j^{th} criterion variable;

w_{kj} is the canonical weight for the j^{th} criterion variable;

and, the k^{th} canonical variate for the explanatory variables is

$$H_k = \sum v_{kj}X_j \qquad (4.7)$$

where,

X_j is the j^{th} explanatory variable; and

v_{kj} is the canonical weight for the j^{th} explanatory variable.

Selecting The Number Of Pairs Of Canonical Variates

When deciding on a minimum number of pairs of canonical variates that should be interpreted, three criteria are recommended:

(1) magnitude of the canonical correlation,

(2) level of statistical significance of the canonical correlation, and

(3) the redundancy measure of shared variance for the canonical variates.

These three criteria should be used in conjunction with one another, since the use of a single criteria may lead to unreliable conclusions.

Magnitude Of Canonical Correlation. The canonical correlation is a measure of the strength and direction of the linear relationship between the pairs of canonical variates. By squaring the canonical correlation, a canonical root is obtained. The canonical root is also called the canonical R^2. It represents the amount of variance in one canonical variate that is accounted for by the other canonical variate. In other words, it is the amount of shared variance between the two canonical variates.

The magnitude of the canonical correlation should be examined when interpreting pairs of canonical variates. Because no generally accepted guidelines have been established regarding acceptable magnitudes for

canonical correlations, it is up to the analyst to decide if the findings contribute to better understanding of the research problem being studied. One must bear in mind that canonical correlations refer to the variance explained in the canonical variates (linear combinations) not the original variables.

Level Of Statistical Significance. Several statistics can be used for evaluating the significance of the canonical correlation. The most widely used test is the F-statistic based on Rao's approximation. The .05 level has become the generally accepted level for considering a canonical correlation coefficient statistically significant. However, deviation from this level may be acceptable depending on the nature of the discipline of the research (Hair, Anderson, and Tatham, 1987). Again, analyst discretion must be used.

Redundancy Measure. While the canonical root gives a measure of the amount of shared variance between the canonical variates, it does not utilize the amount of shared variance in the original variable set accounted for by the other variable set.[1] A measure developed by Stewart and Love (1968) providing this information is called the redundancy index. It is analogous to multiple regression's R-squared statistic, and its value as an index is similar. A redundancy index is helpful in exposing bias and uncertainty in using canon-

ical roots (squared canonical correlations) as a measure of shared variance. In order to have a high redundancy index, one must have a high canonical correlation and a high degree of shared variance explained by the criterion variate. A high canonical correlation alone does not ensure a valuable canonical structure.

Calculation of the redundancy index is a two-step process. The first step involves calculating the amount of variance from the criterion set of variables that is included in the criterion canonical variate. This is accomplished by first computing the canonical loadings which represent the correlation between each input variable and its own canonical variate. That is, the k^{th} vector of canonical loadings for the tx1 vector of criterion variables Y is

$$\begin{aligned} \text{Corr}(Y,G_k) &= \{\text{Corr}(Y_j,G_k)\}_{tx1} \\ &= R_{11}W_k \end{aligned} \qquad (4.8)$$

where,

R_{11} is the sample correlation matrix for the criterion variables; and

$\text{Corr}(Y_j,G_k)$ is the j^{th} criterion canonical loading.

Similarly, the k^{th} vector of canonical loadings for the dx1 vector of explanatory variables X is

$$\text{Corr}(X,H_k) = \{\text{Corr}(X_j,H_k)\}_{dx1}$$
$$= R_{22}V_k \qquad (4.9)$$

where,

R_{22} is the sample correlation matrix for the explanatory variables; and

$\text{Corr}(X_j,H_k)$ is the j^{th} explanatory canonical loading.

By squaring each of the criterion loadings, one may obtain a measure of the amount of variation in each of the criterion variables that is explained by the criterion canonical variate. To calculate the amount of shared variance that is explained by the canonical variate, a simple average of the squared canonical loadings is used. Thus, this quantity is given by

$$\bar{L}_{Yk}^2 = (1/t) \sum [\text{Corr}(Y_j,G_k)]^2 \qquad (4.10)$$

where, $\text{Corr}(Y_j,G_k)$ is the j^{th} loading of the k^{th} vector of canonical loadings (See Equation 4.8).

The second step involves calculating the percentage of variance in the criterion canonical variate that can be explained by the explanatory canonical variate. This is done by squaring the canonical correlation. The squared canonical correlation is commonly called the canonical R^2 or the canonical root.

The redundancy index is then found by multiplying the values obtained in step one and two. That is, the k^{th} redundancy index is given by

$$RD_k = \lambda_k \bar{L}_{Yk}^2 \qquad (4.11)$$

where,

λ_k is the squared canonical correlation; and

$\bar{L}_{Yk}^2$ is the average of the squared canonical loadings (See Equation 4.10).

Thus, the redundancy index is the proportion of shared variance of the criterion variables explained by both the explanatory canonical variate and the criterion canonical variate.

As with canonical correlations, no generally accepted guidelines have been established for the minimum acceptable redundancy index needed to justify the interpretation of canonical structures. Each canonical structure must be judged in light of its theoretical and practical significance to the research problem being investigated to determine if the redundancy index is sufficient to justify interpretation.

Interpretation of Results

If the magnitudes of the canonical root and the redundancy index are acceptable and the canonical relationship is statistically significant, the next step is interpretation of the results to determine the relative importance of each of the original variables in deriving the canonical relationships. For this purpose, the ana-

lyst can use canonical weights, canonical loadings, or canonical cross-loadings.

One approach to interpreting the canonical structures involves examining the sign and magnitude of the canonical weights (w_{kj} and v_{kj}) assigned to each variable in computing the canonical variates. Variables with relatively larger weights contribute more to the structures and smaller weights suggest less contribution. Variables whose weights have opposite signs have inverse relationships with one another. Variables whose signs are the same have a direct relationship with each other. It should be noted that the canonical weights are within set relationships with regard to sign and magnitude. However, considerable caution should be taken when using canonical weights for interpretation. A small weight may mean either that its corresponding variable is irrelevant in determining a relationship or that it has been partialed out of the relationship because of a high degree of multicollinearity. Another problem with the use of canonical weights for interpretation is that considerable variability may occur in weights from one sample to another. This is because the canonical analysis procedure yields weights that maximize the canonical correlations for a particular sample of observed criterion and explanatory variable sets.

Because of the deficiencies in utilizing canonical weights, canonical loadings have been used more often in

recent years. Canonical loadings or structure correlations, as they are sometimes called, measure the simple linear correlation between an original observed variable in the criterion or explanatory set and the set's canonical variate. Thus, the canonical loadings, as in Equations 4.8 and 4.9, reflect the variance that the observed variables share with the canonical variate and assess the relative contribution of each variable to each canonical structure.

Canonical loadings like weights may be subject to variability from one sample to another. This suggests that canonical loadings are sample specific. Even though canonical loadings are more valid than weights, the analyst should be cautious when using loadings for interpreting canonical relationships, particularly with regard to the validity of the findings for uses outside the sample.

Another quantity that is useful for interpreting the results is the canonical cross-loading. Unlike the canonical loadings, which are within set measures of relationships, the canonical cross-loadings are between set measures of relationships. They are simply the correlation between variables in one set with the canonical variate of the opposite set. Cross-loadings are obtained by taking the product of the canonical correlation coefficient and the canonical loading.[2] That is, the canonical cross-loading for the j^{th} explanatory

variable and the k^{th} canonical variate for the criterion variables is

$$Corr(X_j,G_k) = Corr(X_j,H_k)(\lambda_k)^{1/2} \quad (4.12)$$

where $Corr(X_j,H_k)$ is defined in Equation 4.9.

The canonical cross-loading for the j^{th} criterion variable and the k^{th} canonical variate for the explanatory variables is

$$Corr(Y_j,H_k) = Corr(Y_j,G_k)(\lambda_k)^{1/2} \quad (4.13)$$

where $Corr(Y_j,G_k)$ is defined in Equation 4.8.

Among these three methods discussed the use of cross-loadings is the preferred approach, followed by the use of loadings and then weights. This is because cross-loadings are more conservative, less inflated than within set loadings, and form a more solid basis for interpretation. Furthermore, they isolate the relationship of each variable separately with the canonical variate from the other set. Thus, cross-loadings provide a more direct measure of the criterion-explanatory variable relationships, which are the primary relationships this study is interested in exploring.

In summary, when interpreting the results of canonical correlation, it is important to keep the following limitations in mind: 1) the canonical correlation reflects the variance shared by the linear composites of the sets of variables, not the variance extracted from

the original variables; 2) canonical weights derived in computing canonical structures are subject to a great deal of instability; 3) canonical weights are derived to maximize the correlation between linear composites, not the variance extracted; and 4) it is difficult to identify meaningful relationships between the subsets of criterion and explanatory variables because precise statistics have not yet been developed to interpret canonical analysis and we must rely on inadequate measures such as loadings or cross-loadings.

However, canonical correlation analysis is useful as a descriptive and exploratory technique. Canonical analysis results provide information concerning the number of ways in which the two sets of multiple variables are related, the strengths of the relationships, and the nature of the relationships so defined.

It should be noted again that this technique is used to analyze several criterion variables with several explanatory variables simultaneously. It is especially appropriate when the criterion variables are themselves correlated. In such cases, it may uncover complex relationships that reflect a structure between the explanatory and criterion variables which may not be revealed in other types of statistical analysis.

One example of an appropriate use of canonical analysis is where an unmanageably large number of bivariate correlations between sets of variables can be combined

into a composite measure. The technique is useful for identifying overall relationships between multiple criterion and explanatory variables, particularly when little prior knowledge about relationships among the sets of variables exists. The analyst can apply canonical correlation analysis to a set of variables, select those variables (both criterion and explanatory) that appear to be significantly related, and run subsequent canonical correlations with the more significant variables remaining, or individual regressions.

When only one criterion variable is considered, canonical correlation analysis reduces to multiple regression (correlation) analysis (Dillon and Goldstein, 1984). The difference between using multiple regression analysis on each separate criterion variable as opposed to analysis of a set of criterion variables as in canonical correlation is that multiple regression ignores any possible interrelationships that exist among the criterion variables. Canonical correlation incorporates these interrelationships; therefore, providing more information about the variable associations.[3] A more detailed discussion of canonical correlation analysis is given in Dillon and Goldstein (1984).

Data Set Description

The data set was constructed from two sources: a mailed survey and five years of financial data collected

from state auditors. Three time scenarios were analyzed: a five year average of years 1981-1985, a three year average of years 1983-1985, and a one year time period of 1985.

Nineteen explanatory variables were used in the model. Table XXI gives a listing of these variables. All were considered theoretically sound, but the degree of significance they had on the criterion variables was not known. Therefore, the statistical analysis was used to provide this information.

The criterion variables used were net savings after taxes, return on assets, and return on equity. These were quantifiable measures of success that cooperative managers had identified that they used in their evaluation process. Since cooperatives in this study receive at least half of their net savings in the form of patronage dividends from regional cooperatives of which they are members, the three success measures were evaluated in two categories: total, which includes regional distributions, and local, which excludes these returns.

TABLE XXI

EXPLANATORY VARIABLES USED IN STATISTICAL ANALYSIS

Explanatory Variables
Number of Branch Elevators
1985 Wheat Volume
Offers Services That Do Not Break Even
Cooperative Membership
Offer Volume Discount
Number of Competitors
Number of Cooperative Competitors
Management Programs Attended Last Two Years
Years as Manager
Years as an Assistant Manager, Foreman, or Bookkeeper
Tenure of Board of Directors
Management Incentives
Employee Incentives
Number of Employees
Use Written Operating Plan
Monthly Evaluations of Financial Records
Management's Formal Education After High School
Debt to Equity Ratio
Manager Salary

ENDNOTES

[1]The redundancy index can be computed for the explanatory set given the criterion set as well as for the criterion set given the explanatory set. This study will focus on the latter.

[2]There are some elements in common in the calculation of the canonical cross-loadings and in the calculation of the redundancy index. Timm (1975) discusses two methods of calculating the redundancy index in which one of these methods uses canonical cross-loadings.

[3]For further details on the relationship of canonical correlation analysis and the general linear multivariate model see Muller (1982).

CHAPTER V

RESULTS OF THE ANALYSIS

Correlation Analysis Results

As previously discussed, correlation analysis measures the extent of association between variables. Three time scenarios were used in the calculation of correlation coefficients for criterion and explanatory variables. There is also a distinction made between total and local measurements. A listing of the variables, code names, and their units is given in Table XXII.

All the criterion variables were highly correlated with each other. The greatest association between criterion variables existed between the return on equity variables and the return on asset measurements. This is expected since they are both derived by using net savings after taxes as a numerator.

Correlations between criterion and explanatory variables that have a magnitude of .5 or greater are presented in Table XXIII. For a more complete set of correlations between criterion and explanatory variables see Appendix C. Notice that among the explanatory vari-

TABLE XXII

LIST OF VARIABLES, CODE NAMES, AND UNITS

Code Name	Variable	Unit
Criterion Variables:		
NETSAV	Total Net Savings After Taxes	Dollars
REQ	Total Return on Equity	Ratio
RAS	Total Return on Assets	Ratio
LNETSAV	Local Net Savings After Taxes	Dollars
LREQ	Local Return on Equity	Ratio
LRAS	Local Return on Assets	Ratio
Explanatory Variables:		
BREV	Number of Branch Elevators	Elevators
VOL	1985 Wheat Volume	Thousand Bushels
EMPINC	Offers Employee Incentive	1=yes 0=no
LOSPROF	Offers Services that don't Break Even	1=yes 0=no
OPPLAN	Use Written Operating Plan	1=yes 0=no
MEMBERS	Cooperative Membership	Members
VOLDISC	Offer Volume Discount	1=yes 0=no
COMP	Number of Competitors	Elevators
COOPCOMP	Number of Cooperative Competitors	Elevators
MNGPROG	Management Programs Attended Last Two Years	Days
MNG YRS	Years as Manager	Years
ASSTYRS	Years as an Assistant Manager, Foreman, or Bookkeeper	Years
BD YRS	Average Tenure of Board of Directors	Years
MNGINC	Management Incentives	1=yes 0=no
WORKERS	Number of Employees	Employees
FINEVAL	Monthly Evaluations of Financial Records	1=yes 0=no
MNGEDUC	Management's Formal Education After High School	Years
D/E	Debt to Equity Ratio	Ratio
MNGSAL	Manager Salary	Dollars

TABLE XXIII

SELECTED CORRELATION COEFFICIENTS

Variable Correlations:	Correlation Coefficients		
	Five Year Average	Three Year Average	1985 Data
Criterion - Criterion Correlations:			
Net Savings - Return on Equity	.83	.87	.84
Net Savings - Return on Assets	.87	.90	.89
Return on Equity - Return on Assets	.97	.98	.98
Local Net Savings - Local Return on Equity	.89	.88	.88
Local Net Savings - Local Return on Assets	.93	.91	.92
Local Return on Equity - Local Return on Assets	.98	.98	.98
Criterion - Explanatory Correlations:			
Net Savings - Volume Discount	***	***	-.52
Net Savings - Manager Salary	.55	.53	***
Net Savings - Management Incentive	.53	.52	***
Net Savings - Debt to Equity Ratio	-.59	-.63	-.54
Return on Equity - Volume Discount	-.62	-.50	-.58
Return on Equity - Management Incentive	.56	.51	***
Return on Equity - Debt to Equity Ratio	-.70	-.74	-.55
Return on Equity - Manager Salary	***	.52	***
Return on Asset - Volume Discount	-.63	-.52	-.60
Return on Asset - Management Incentive	.57	.52	.51
Return on Asset - Have Written Operating Plan	-.50	***	***
Return on Asset - Debt to Equity Ratio	-.77	-.77	-.59
Local Net Savings - Volume Discount	-.51	-.51	-.55
Local Net Savings - Management Incentive	.51	***	***
Local Net Savings - Debt to Equity Ratio	-.65	-.62	-.52
Local Return on Equity - Volume Discount	-.52	***	-.55
Local Return on Equity - Management Incentive	.52	***	***
Local Return on Equity - Debt to Equity Ratio	-.74	-.70	-.59
Local Return on Assets - Volume Discount	-.55	***	-.58
Local Return on Assets - Management Incentives	52	***	***
Local Return on Assets - Debt to Equity Ratio	-.72	-.67	-.55
Explanatory - Explanatory Correlations:			
Manager Salary - 1985 Wheat Volume	.50	.50	.50
Number of Branch Elevatory - 1985 Wheat Volume	.54	.54	.54
Cooperative Membership - Number of Employees	.52	.52	.52
Have Written Operating Plan - Debt to Equity Ratio	.54	.50	***

*** Absolute value is less than .5

ables, net savings after taxes has the highest association with: volume discount, manager salary, management incentives, and debt to equity ratio. Local net savings is also highly associated with these variables with the exclusion of manager salary. Return on equity and local return on equity made the same high associations as the net savings variable.

Return on assets was more associated with volume discount, management incentive, existence and use of a written operating plan, and debt to equity ratio. The local return on assets made the same associations with the exception of the written operating plan.

Among the criterion-explanatory variable associations, the largest association measurement with each criterion variable was with the debt to equity ratio. This is an expected occurrence since high debt to equity ratios would tend to have a strong diminishing effect on the various measures of success.

There were only four sets of association among the 19 explanatory variables with correlation coefficients of at least 0.50. All of these values were less than 0.55. The associations that existed were between manager salary and the 1985 wheat volume, number of branch elevators and the 1985 wheat volume, the number of cooperative members and the number of employees, and the existence of a written operating plan and the debt to equity ratio. Some associations were clear as in the

case where wheat volume increases with the number of branch elevators. It also seems reasonable that cooperatives with larger membership would have a larger number of employees to provide the needed service than cooperatives with smaller membership.

Regression Analysis Results

To determine the extent of the relationship between the criterion variables and the explanatory variables, regression analysis was used. As stated earlier, theory implies that there are many explanatory variables that explain the variation in the criterion variables. One method of choosing a smaller subset of explanatory variables is the stepwise regression procedure. This technique is used to provide information about a single criterion variable as explained by a set of significant explanatory variables.

In this section, each relationship is expressed in equation form. Coefficient estimates and signs for each explanatory variable and intercept are presented. SAS, a computer software package, was used for estimation. The Student's t-values are in parentheses directly below the corresponding exogenous variable. The t-values that are significant at the 0.05 probability level are denoted by an asterisk (*). R^2 and F-values for each equation are also presented below the equations. The results are presented by success measurement. Each suc-

cess measurement contains three equations, one for each time scenario. The subscripts are used to denote the number of years of data that was averaged and used in the corresponding model. There are two categories for each success measurement. Total returns include regional patronage dividends to the cooperative. Local returns exclude these dividends. The coefficients of the variables are presented in equation form. However, discussion focuses on the sign and explanation of relationships between criterion and predictor variables. This is due to the exploratory nature and purpose of the study as opposed to predictive interpretation.

To determine if problems existed with heteroscedasticity in these models, all criterion and explanatory variables were plotted against the residuals (Kennedy, 1981). No pattern existed that would indicate that heteroscedasticity was a major problem.

Total Net Savings After Taxes

Equation 5.1 shows the five year average relationship between net savings after taxes and debt to equity ratio, 1985 wheat volume, and manager education.

$$\begin{aligned} NETSAV_5 = \; & 79721.934 - \underset{(-5.67)^*}{259769.331}\ D/E_5 \\ & + \underset{(4.10)^*}{154.580}\ VOL + \underset{(1.17)}{13626.586}\ MNGEDUC \end{aligned} \qquad (5.1)$$

$R^2 = 0.59$ F-value = 16.12

Debt to equity is negatively related to net savings after taxes. Since higher debt relationships reduce a firms profitability this relationship is expected. As volume increases, more money is made through trade by cooperatives, thus the positive relationship in this situation is justifiable. Manager's education is positively related to net savings. This could be attributed to formal education which provides training in such areas as accounting, finance, management, etc., that facilitate the operation of the cooperative.

The three year average analysis differs slightly as seen in Equation 5.2.

$$NETSAV_3 = 110780.138 - \underset{(-4.28)*}{210156.340}\ D/E_3 + \underset{(2.31)*}{94.441}\ VOL + \underset{(1.64)}{65484.479}\ MNGINC \qquad (5.2)$$

$R^2 = 0.56$ F-value = 14.00

Net savings in Equation 5.2 is negatively related to the debt to equity ratio and positively related to volume, but in the three year average analysis we see management incentive instead of the education variable that was in the five year analysis. The positive relationship between management incentive and net savings implies that motivation to increase the financial standing of the cooperative is influenced by the manager's opportunity to personally gain from this success.

The 1985 analysis has fewer variables entering the

model. Equation 5.3 shows only the debt to equity ratio and management incentive as being related to net savings after taxes.

$$NETSAV_1 = 134791.545 - \underset{(-2.92)*}{170796.256}\ D/E_1 + \underset{(2.30)*}{104591.464}\ MNGINC \quad (5.3)$$

$R^2 = 0.39$ F-value = 10.69

Local Net Savings After Taxes

Local net savings after taxes exclude dividends paid to the cooperative by regional cooperatives of which the local cooperative is a member-owner. This situation reflects the local cooperatives standing without dependence on outside sources of income. Equation 5.4 shows the five year average analysis of the local net savings after taxes relationship.

$$LNETSAV_5 = 92747.070 - \underset{(-4.51)*}{209972.991}\ D/E_5 + \underset{(1.79)}{70.394}\ VOL + \underset{(1.64)}{62913.416}\ MNGINC \quad (5.4)$$

$R^2 = 0.55$ F-value = 13.63

The relationships in this equation are the same as in the three year average analysis of the total net savings (Equation 5.2). Only the magnitude of the coefficients differ.

Except for the difference in coefficient magni-

tudes, the three year average analysis of the local net savings after taxes reflects the same relationships as the 1985 analysis of total net savings. This can be seen in comparing Equation 5.5 with Equation 5.3.

$$LNETSAV_3 = 110127.063 - \underset{(-3.76)*}{195962.231}\ D/E_3 + \underset{(2.06)*}{82097.497}\ MNGINC \qquad (5.5)$$

$R^2 = 0.45$ F-value = 14.12

Equation 5.6 presents the one year analysis of the local net savings after taxes relationship. Debt to equity ratio remains in the relationship but volume discount enters the equation as a significant explanatory variable. This relationship is negative because as volume discounts are offered and used by cooperative members, less money is obtained. Thus, net savings are reduced. However, many cooperatives offer these to increase the total volume traded which will actually add to net savings over time.

$$LNETSAV_1 = 147725.939 - \underset{(-2.45)*}{136136.182}\ D/E_1 - \underset{(-2.80)*}{114748.410}\ VOLDISC \qquad (5.6)$$

$R^2 = 0.41$ F-value = 11.15

Total Return On Equity

The results of the five year average analysis of total return on equity is presented in Equation 5.7.

$$REQ_5 = 0.136 - \underset{(-5.04)*}{0.086}\ D/E_5 - \underset{(-3.69)*}{0.05}\ VOLDISC + \underset{(1.80)}{0.028}\ MNGINC + \underset{(1.89)}{0.025}\ EMPINC \qquad (5.7)$$

$$R^2 = 0.75 \qquad \text{F-value} = 23.10$$

In return on equity, as in the case of net savings, we expect the negative relationship that exists with the debt to equity ratio. The more debt the cooperative has outstanding the less return on equity available. The volume discount offered reduces the net revenue to the cooperative leaving less return on equity. Thus, a negative relationship exists between the two variables. Management incentive is positively related to return on equity implying motivation to increase return on equity is influenced by the bonus offered to managers. Employee incentive is also positively related to the return on equity. The implication is that if employees are rewarded by cooperative success, they will strive to perform their duties in such a way that provides better service to customers and profitability to the cooperative.

Equation 5.8 exhibits the results of the three year

average analysis for return on equity. These results differ some from the five year average analysis.

$$REQ_3 = 0.033 - \underset{(-5.44)*}{0.121}\ D/E_3 - \underset{(-2.24)*}{0.035}\ VOLDISC + \underset{(1.92)}{0.000002}\ MNGSAL + \underset{(1.33)}{0.0049}\ MNGEDUC \qquad (5.8)$$

$R^2 = 0.69$ F-value = 16.58

The debt to equity ratio and volume discount are again negatively related to return on equity as in the five year average analysis. Two variables reflecting management impact enter the three year average relationship. Manager salary is positively related to return on equity. The rationale for this variable is similar to the incentive variables. The more reward a manager is given for their service the more motivation they have to provide service to enhance the success of the cooperative. Manager's education also positively contributed to return on equity. Education provides skills and talents which managers can utilize to obtain higher levels of success.

The 1985 analysis results can be seen in Equation 5.9. Debt to equity ratio and volume discount were negatively related to return on equity and a positive relationship existed between the criterion variable and the number of management programs the manager attended in the last two years. This positive relationship suggests that the training managers receive at these programs

enhances their ability to increase their cooperative's return on equity.

$$REQ_1 = 0.10 - \underset{(-2.86)*}{0.084\ D/E_1} - \underset{(-3.06)*}{0.068\ VOLDISC} + \underset{(1.60)}{0.0015\ MNGPROG} \quad (5.9)$$

$R^2 = 0.49$ F-value = 9.47

Local Return on Equity

The local return on equity for the three time scenarios had fewer explanatory variables in their equations than the relationships that existed when including regional patronage dividends into the financial information. The rationale for variables entering these models was consistent with previous explanations. The five year average analysis seen in Equation 5.10 had two explanatory variables enter the model: debt to equity ratio and management incentive.

$$LREQ_5 = 0.078 - \underset{(-5.48)*}{0.135\ D/E_5} + \underset{(2.40)*}{0.046\ MNGINC} \quad (5.10)$$

$R^2 = 0.61$ F-value = 26.59

Equation 5.11 shows the results from the three year average analysis on local return on equity. Debt to equity ratio and manager salary were significant variables in relation to local return on equity.

$$LREQ_3 = -0.028 - \underset{(-4.89)*}{0.139}\ D/E_3 + \underset{(2.35)*}{0.0000032}\ MNGSAL \qquad (5.11)$$

$R^2 = 0.56$ F-value = 21.46

The one year analysis yielded a negative relationship between the criterion variable, local return on equity, and two explanatory variables: debt to equity ratio and volume discount. These are exhibited in Equation 5.12.

$$LREQ_1 = 0.076 - \underset{(-3.13)*}{0.098}\ D/E_1 - \underset{(-2.80)*}{0.064}\ VOLDISC \qquad (5.12)$$

$R^2 = 0.47$ F-value = 14.19

Total Return on Assets

The results of the five year average analysis can be seen in Equation 5.13.

$$RAS_5 = 0.109 - \underset{(-6.13)*}{0.076}\ D/E_5 - \underset{(-3.45)*}{0.032}\ VOLDISC + \underset{(2.58)*}{0.026}\ MNGINC \qquad (5.13)$$

$R^2 = 0.78$ F-value = 37.00

The negative relationship between the debt to equity ratio and return on assets is consistent with the prior economic reasoning. Volume discount was nega-

tively related to return on assets since it causes a reduction in potential net savings which is used in the numerator of the return to asset calculation. The positive relationship between management incentive and return on assets implies that as the manager is rewarded in proportion to financial growth for improvements he develops higher motivation to improve the financial standing of the cooperative.

The three year average analysis and the one year analysis equations had the same relationships in criterion and explanatory variables as the five year average analysis. However, the coefficient magnitudes differed slightly. The three year average analysis is presented in Equation 5.14.

$$RAS_3 = 0.088 - \underset{(-5.62)*}{0.085}\ D/E_3 - \underset{(-2.21)*}{0.025}\ VOLDISC + \underset{(1.91)*}{0.023}\ MNGINC \qquad (5.14)$$

$R^2 = 0.70$ F-value = 24.07

Equation 5.15 contains the results of the one year analysis on return on assets.

$$RAS_1 = 0.076 - \underset{(-2.85)*}{0.057}\ D/E_1 - \underset{(-2.47)*}{0.042}\ VOLDISC + \underset{(1.81)}{0.029}\ MNGINC \qquad (5.15)$$

$R^2 = 0.57$ F-value = 13.42

Local Return on Assets

The five year average analysis on local return on assets was consistent in relationships with the previous three equations on return to assets. This can be viewed in Equation 5.16.

$$LRAS_5 = 0.069 - \underset{(-4.68)*}{0.077\ D/E_5} - \underset{(-2.29)*}{0.028\ VOLDISC} + \underset{(1.72)}{0.023\ MNGINC} \qquad (5.16)$$

$R^2 = 0.65$ F-value = 19.24

The three year average analysis of local return on assets yielded a different set of relationships as seen in Equation 5.17.

$$LRAS_3 = -0.01 - \underset{(-4.47)*}{0.089\ D/E_3} + \underset{(2.18)*}{0.0000021\ MNGSAL} \qquad (5.17)$$

$R^2 = 0.52$ F-value = 18.05

The debt to equity ratio and local return on assets negative relationship is consistent with prior economic reasoning. Manager salary is positively related to local return on assets, implying that better paid managers have more motivation to increase the local cooperatives return on assets since they are financially rewarded for their talents and efforts.

In the one year analysis, debt to equity ratio and

volume discount explanatory variables have significant relationships with local return on assets. Both are negatively related to the criterion variables seen in Equation 5.18.

$$LRAS_1 = 0.058 - \underset{(-2.65)*}{0.058\ D/E_1} - \underset{(-3.06)*}{0.049\ VOLDISC} \qquad (5.18)$$

$R^2 = 0.45$ F-value = 13.17

Comparisons of Regression Analysis Results

Table XXIV gives a comparative summary of the regression analysis relationships. Positive or negative signs and the R^2 values for each of the equations is presented. The longer time periods yield results with higher R^2 values. This is partially due to the fact that more variables are included in the model, therefore, increasing the value of R^2. Also, in most cases, the relationships among the equations with values including regional patronage dividends have higher R^2 values than the equations with only local returns for the same time scenario.

The debt to equity ratio was present in all equations. In the net savings after taxes, management incentive and volume enter at least half of the equations. Volume discount plays a fairly strong role in many of the return on equity equations. Variables

TABLE XXIV

COMPARATIVE SUMMARY OF REGRESSION ANALYSIS RELATIONSHIPS: SIGN AND R^2 VALUES

Variable Code Name	Description	Net Savings After Taxes						Return on Equity						Return on Assets					
		5 Year Ave		3 Year Ave		1985		5 Year Ave		3 Year Ave		1985		5 Year Ave.		3 Year Ave		1985	
		Total	Local	Total	Local	Total	Local	Total	Local	Total	Local	Total	Local	Total	Local	Total	Local	Total	Local
D/E	Debt to Equity Ratio	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
VOLDISC	Volume Discount						-	-		-		-	-	-	-	-		-	-
MNGINC	Management Incentive		+	+	+	+		+	+					+	+	+		+	
VOL	Volume	+	+	+															
MNGSAL	Manager Salary									+	+						+		
MNGPROG	Programs Attended by Manager											+							
MNGEDUC	Manager Education	+								+						+			
EMPINC	Employee Incentive							+						+					
R^2 Values		.59	.55	.56	.45	.39	.41	.75	.61	.69	.56	.49	.47	.78	.65	.70	.52	.57	.45

denoting managers importance to return on equity include management incentive, manager's salary, manager's formal education, and training programs managers attended within the last two years. The three variables highly significant in explaining the variation in the return on assets variable are debt to equity ratio, volume discount, and management incentive.

The comparison table provides some interesting information. The 1985 analysis rarely included a variable denoting the manager's direct involvement. This is not too surprising since it may take longer than one year for a manager to make an impact on cooperative success. However, in the longer term analysis, we usually see at least one variable entering the model that emphasizes this aspect. Since salary and monetary incentives positively influence cooperative success, attention should focus on hiring and/or rewarding skillful managers monetarily. Board of directors should see salary and wages as measures of quality as opposed to an expense. Education and training of managers plays an important role in cooperative success. Also, it should be noted that volume was only significant in determining net savings after taxes and not return on equity or assets.

Canonical Correlation Analysis Results

There are times when a decision maker will be interested in looking at a set of criterion variables as opposed to a single criterion variable. For this, canonical correlation analysis is an appropriate choice of analysis. Canonical correlation maximizes correlation between a weighted combination of explanatory variables and a weighted combination of criterion variables.

In this section, discussion will focus first on reporting values for criteria used to establish confidence in the canonical function. The criteria discussed will include canonical correlations and canonical R^2 values, significance level of the F-statistic, and the redundancy index. This will be followed by a discussion of the explanatory variables making the most contribution to the canonical function as indicated in the canonical cross-loadings.

These values are presented in Table XXV. A complete listing of the canonical cross-loadings can be found in Appendix D. The following is a summary of the results from canonical correlation analysis.

Five Year Analysis

In the total five year average analysis, the canonical correlation among the first set of canonical vari-

TABLE XXV

CANONICAL CORRELATION RESULTS

Criteria Used To Establish Confidence In The Canonical Function	Five Year Analysis		Three Year Analysis	
	Total	Local	Total	Local
Canonical Correlation	0.94	0.96	0.94	0.94
Canonical R^2	0.88	0.92	0.88	0.88
Observed Significance Level based on F distribution	0.01	0.08	0.03	0.16
Redundancy Index	0.57	0.53	0.51	0.41
Largest Contributing Canonical Cross-Loadings				
D/E	-.67	-.67	-.58	-.62
VOLDISC	-.59		-.35	
MNGINC	.50	.44	.44	.41
MNGSAL		.37	.53	.45

ates was .94. Only six percent of the shared variance remained to be explained by subsequent pairs of canonical variates. Therefore, discussion will focus only on the first pair of canonical variates.

The squared canonical correlation also called the canonical R^2 or canonical root is .88. This is interpreted as 88 percent of the variance in the canonical criterion variate is accounted for by the other canonical explanatory variate.

To test the hypothesis that the canonical correlation was equal to zero, an F-statistic was used. The valued of the F-statistic was 2.23. Therefore, the hypothesis is rejected and the canonical correlation is statistically significant at the .01 level.

The redundancy index is a two part calculation. The value for the standardized variance of the criterion measurements explained by their own canonical variate was .6439. By multiplying this value by the canonical R^2 (.8839) we obtain the redundancy index. This value is .5691. Recall that the redundancy index is a summary measure of the ability of a set of explanatory variables (taken as a set) to explain variation in the criterion variables (taken one at a time) and is analogous to multiple regression's R^2 statistic.

Examination of the canonical cross-loadings show that the factors that were most significant were debt to equity, volume discount, and management incentive. The

debt to equity ratio significantly influenced the three criterion variables. A large degree of leverage can jeopardize a business depending on the nature of the business. In agriculture, highly leveraged firms such as grain cooperatives stand to have their existence threatened by the economic problems faced by patrons.

Volume discount is one of the techniques farm cooperatives use to give more equitable treatment to farmers. Customers buying large quantities from the cooperative receive a discount. Without, such practices many cooperative customers would choose to trade elsewhere because of the economic incentive. The practice of volume discounts also reduces the subsidization of the smaller patron with purchases from larger volume buying members. For smoother operation of this principle, definite boundaries (limits) should be established for all who wish to trade with the cooperative. This insures that each patron that wants to buy a specific quantity will receive a standardized discount.

Management incentive is also an important aspect of these criterion variables, particularly in the long run. If a manager is rewarded when the cooperative is experiencing increased success, then he or she is more apt to take a personal role in the cooperative's direction as opposed to treating the position as a mere eight-to-five job.

In the local five year average data analysis, the

first canonical correlation was .96. Thus, the squared canonical correlation accounted for 92 percent of the variance between the canonical variates. The canonical correlation was statistically significant at the .08 level. The redundancy index value was .53.

As for canonical cross-loadings, the factors that were most significant were debt to equity, management incentive, and manager's salary. Since the data for this analysis excludes any patronage refund from regional cooperatives and relies solely on the returns acquired by the local cooperative, it is not too surprising that leverage and management were the prime variables of significance. Leverage is crucial to a cooperative which cannot rely on outside sources of income to balance the operation. Management incentives and salaries are particularly important in the long run. If the manager and possibly the employees are rewarded by cooperative economic success, there is usually more incentive to make that extra effort that positively affects patrons and enhances the business.

Three Year Analysis

The three year average data analysis, which is an intermediate term analysis, yields similar results to the five year analysis. In the analysis involving the additional earnings from the regional cooperative the canonical correlation coefficient was .94. Therefore,

the square correlation coefficient accounted for 88 percent of the shared variance between the canonical variates. The canonical correlation coefficient was significant at the .03 level and the redundancy index was .51.

Cross-loadings demonstrated that criterion variables were most related to the following factors: debt to equity, manager salary, management incentive, and volume discount.

The analysis involving only local returns yielded the following results. The canonical correlation coefficient was .94 and the canonical R^2 was 88 percent. The canonical correlation coefficient was statistically significant at the .16 level. This measure indicates a fairly large probability of error is possible. The redundancy index is .41. These values diminish the canonical correlations validity, however, they are not so large as to discredit the results. The factors most significant in the cross-loadings were debt to equity, manager's salary, and management incentive.

One Year Analysis

The one year analysis results were not satisfactory. Even though the total values for the canonical correlation was .91 and the canonical R^2 was .83, the two other criteria used to establish credibility of the canonical correlation were unsatisfactory. The canonical correlation was statistically significant at the .30

level and the redundancy index was .16. Values for the local analysis were similar. Therefore, the results of the one year analysis cannot be viewed with much confidence.

Comparison of Canonical Correlation Analysis Results

The local five year and local three year analysis have three factors in common that make up the strongest relationship between the criterion set and the explanatory set. These explanatory variables are debt to equity, manager's salary, and management incentive. Only the order of importance of the latter two is switched. The total five year and the total three year analysis match with one exception. Both include debt to equity, volume discount, and management incentive; however, the total three year analysis includes manager's salary.

Summary and Conclusions of Chapter V

When comparing the results of the regression analysis as in Table XXIV with the canonical correlations results in Table XXV, we can see many of the same variables playing a strong role in both results of the two techniques. Results for the one year analysis cannot be compared due to the unsatisfactory results of the canonical correlation analysis. However, it is interesting to note that the R^2 values for the one year analysis

were lower than the other time scenarios of the corresponding dependent variables.

In all the analysis, the significance of debt to equity to the criterion variables can be seen. This is not too surprising since this variable is composed of an element used or closely associated with the criterion variables. The reasonability of the variables significant role is due to the importance of a firm's leverage to their economic success. For these reasons we see debt to equity play a major role.

Management's importance is also heavily reflected. Monetary incentives seem to be related to greater economic success. Education and training also seem important. Training might be done with more enthusiasm and frequency when opportunity avails if monetary incentives from economic results are available.

Volume and volume discount also enter frequently. Volume discounts is a strategy used by management to encourage large volume patronage. The overall volume traded is usually greater when using this strategy than if the technique was not employed. It makes the cooperative more competitive with its competition and gives more equitable treatment to the membership. Increased volume in the cooperative is also usually related to the management's ability to keep the member-patrons satisfied with their cooperative. This may be somewhat a

function of member education and participation. The quality of competition also plays a role.

CHAPTER VI

SUMMARY, IMPLICATIONS, AND FUTURE RESEARCH

The intent of the study was to investigate and identify factors that are important in explaining cooperative elevator success. Specific objectives included:

(1) Determine alternative measures of cooperative elevator success as perceived by cooperative managers.

(2) Identify those descriptive aspects related to Oklahoma cooperative grain elevators.

(3) Estimate and determine those significant economic and management factors related to alternative quantifiable cooperative grain elevator success measurements.

The first specific objective was accomplished by analyzing results from a survey of cooperative elevator managers. They were asked to identify and rank, in order of importance, factors they used in measuring success for their cooperative. There were many measures used. They included: service to membership, net savings after taxes, return on assets, growth in trade, return on equity, patronage refund in cash, and volume. However, most managers indicated that two of these measures were viewed more important more often than the others.

The measure chosen most frequently was service to membership followed by net savings after taxes. This explains some of the reasons for certain policies such as offering unprofitable services.

Service to membership was highly ranked partially because of the unique philosophy of cooperatives. Many times cooperatives have been organized by a group of people who could not independently afford a service but by collective cooperation could pool their resources to make the service available. Therefore, service to membership is an important criteria to many cooperatives. Choice of net savings after taxes represents the cooperative's goal of continued economic existence. This is the bottom line figure used as a measure of cooperative "profitability". Of course, this return is to be passed back to its membership, but without a positive return the cooperative will be forced out of business.

The second specific objective was to identify the descriptive aspects related to Oklahoma cooperative grain elevators. Chapter III provides information concerning this objective. The description was categorized into the following areas: general description information, membership, board of directors, management, employees, goals and objectives, strategies, financial, and challenges. Tables in Chapter III provide a summary of a large portion of the descriptive information covered in that chapter.

The third objective was to estimate and determine those significant economic and management factors related to alternative quantifiable success measurements for cooperative grain elevators. Chapter IV contains results of analysis which satisfies this objective.

Summary of Analysis

Three methods of analysis were used to provide information about the relationships between the criterion variables and the explanatory variables. The methods were correlation analysis, regression analysis, and canonical correlation analysis.

The data set was constructed from two sources: a mail out survey and five years of financial data collected from state auditors. Nineteen explanatory variables were used in the model. (See Table XXII) The criterion variables used were net savings after taxes, return on assets, and return on equity. These were quantifiable measures of success that cooperative managers had identified that they used in their evaluation process.

Three time scenarios were analyzed: a five year average over years 1981-1985, a three year average over years 1983-1985, and a one year time period of 1985. The success measurements were evaluated in two categories: total returns, which include regional patronage

refunds, and local returns, which excludes these dividends.

Correlation analysis results showed the highest correlation to be between criterion variables. All three criterion variables were highly correlated with one another as shown in Table XXIII.

Correlations between criterion and explanatory variables were not as high as those between criterion variables. Three explanatory variables had a correlation coefficient magnitude of .5 or greater with all three criterion variables for the two time scenarios. These explanatory variables were volume discount, management incentives, and debt to equity. Other explanatory variables that also had a cross-correlation coefficient greater than .5 included manager salary and use of a written operating plan.

There were only four pairs of explanatory variables having correlation coefficient magnitudes of .5 or greater and all were less than .55. These four pairs were between 1) manager salary and 1985 wheat volume, 2) number of branch elevators and 1985 wheat volume, 3) cooperative membership and number of employees, and 4) use of a written operating plan and debt to equity ratio. Relatively low correlations between the remaining explanatory variables suggest that multicollinearity was not a problem in this study.

In the results of the regression analysis, the debt

to equity variable was present in all equations. In the net savings after taxes models, management incentive and volume entered at least half of the equations. Volume discount played a fairly strong role in many of the return on equity equations. There were four variables in the return on equity regression equations denoting manager's influence. These variables were management incentive, manager`s salary, manager's formal education, and training programs managers attended within the last two years. Debt to equity ratio, volume discount and management incentive were highly significant in explaining the variation observed in the return on assets criterion variable.

The 1985 analysis rarely included a variable denoting the manager's direct involvement. This is reasonable since it may take longer than one year for a manager to make an impact on cooperative success. In the longer term analysis, at least one variable denoting manager`s influence entered the model. Since salary and monetary incentives positively influence cooperative success, the board of directors should see these factors as measures of quality as opposed to an expense. Education and training of managers plays an important role in cooperative success. Volume was only significant in determining net savings after taxes and not return on equity or assets.

The canonical correlation analysis yielded results

similar to the regression analysis. With respect to the canonical cross-loadings, explanatory variables which were most related to the set of criterion variables were debt to equity ratio, volume discount, management incentive, and manager's salary. Only five and three year analyses were interpreted since the one year analysis results were not considered satisfactory.

Implications

Implications from the survey summary information and the results of the analysis follow. These implications are summarized in Table XXVI.

The debt to equity ratio plays a strong role in all of the quantifiable criterion variables. Thus, cooperatives should evaluate this ratio carefully. Debt to equity should be evaluated by comparing it to the previous year's ratio within the cooperative. It should also be compared to debt to equity ratios of other successful cooperatives of similar size as well as to industry averages. The current debt to equity ratio should be compared to the net savings after taxes and return on assets and equity. If these variables have declined sharply as in 1983 of this study (see Appendix B), then the cooperative may need to make some rapid changes to accommodate. Otherwise, the cooperative with a large debt to equity ratio may experience severe economic stress when returns to the cooperative are reduced dra-

TABLE XXVI

IMPLICATIONS OF THE STUDY

Implications
Debt to Equity Plays a Strong Role in the Criterion Success Variables Considered in the Study.
Volume Plays a Significant Role Increasing the Potential for Mergers of Small Cooperatives.
Effects of Management Decisions on Success Are Not Immediate.
Boards of Directors Should View Salaries and Incentives as Measures of Quality Instead of an Expense.
Education and Experience of Managers Plays an Important Role in Cooperative Success.

matically. The reduction in returns may be of a large enough magnitude to put the cooperative in a position of being unable to cover its outstanding liabilities.

Another aspect that is closely related is the declining returns to cooperatives from patronage refunds from regional cooperatives. Many cooperatives depend on this return to bring the cooperatives into a profitable position each year. This kind of dependency can be detrimental to cooperatives if regional cooperatives experience financial difficulty. If returns from this source decline, and local cooperatives returns also decline, then debt to equity may present a very real threat to the cooperatives financial status and existence.

Volume plays a significant role which implies the potentiality for mergers of small cooperatives who feel the need to increase this factor. This would also explain any trends of increasing cooperative size in the future.

Management impacts are longer term influences. Salary and monetary incentives positively influence profitability. Therefore, boards of directors should view this as a measure of quality as opposed to an expense. Education, experience, and training of managers also plays an important role in cooperative success. These factors sharpen and increase the manager's skills and

talents enabling them to implement new policies to enhance the success of the cooperative.

Future Research

The implications of this study can be stated as hypotheses which can be tested in a broader population encompassing regional or all United States grain elevator cooperatives.

Furthermore, a subsequent study could survey board members and the membership to see if manager attitudes accurately reflect cooperative conditions. This might identify other potentially beneficial performance factors not recognized by management.

Since only one year of management information was obtainable for this survey, a follow up survey accompanied by current financial information would provide additional information about the manager's impact on cooperative success over time.

Altman discussed how the ratio of retained earnings to total assets could be used to predict business failure one year in advance with accuracy approximately 90 percent of the time. It would be interesting to apply this idea to cooperatives nationwide to see if the application is appropriate for this form of business.

One complaint by managers and board members is the lack of member involvement and loyalty. An in-depth study looking at the various methods employed by cooper-

atives to encourage involvement and loyalty and evaluating the successfulness of these methods would be of value.

Since management is such an important factor in cooperative elevator success, it would be interesting to determine the criteria that boards of directors actually use in hiring and evaluating their managers. This information could then be compared in a future study to the success of those cooperatives after a five year interim to determine how well the criteria that was used worked for those cooperatives. The five year lag would be necessary since evidence of management's influence requires longer time periods than one or two years.

Concluding Remarks

It is hoped that if cooperative decision makers can identify their goals in the form of one or more success factors then the study will provide them with factors to assess in their own organization. By examining current and past information unique to their own cooperative, the cooperative decision makers can recognize areas to focus on and possibly make changes for better attainment of goals.

BIBLIOGRAPHY

Altman, Edward I. "Financial Ratios, Discriminant Analysis and the Prediction of Corporate Bankruptcy." Journal of Finance. XXIII(September 1968): 589-609.

Babb, E.M. and M.D. Van Slyke. "Factors Associated With Successful Management of Country Elevators." Feedstuff, August 21, 1965, pp. 60-62.

Beal, George, Richard Warren, and David Duncan. "Training, Knowledge, Experience -- How They Relate to Managerial Success." News for Farmer Cooperatives. Washington, D.C.: USDA, Farmer Cooperative Service, September 1971, pp. 3-6.

Beierlein, James G., Kenneth C. Schneeberger, and Donald D. Osburn. Principles of Agribusiness Management. Englewood Cliffs, N.J.: Reston Book, 1986.

Benitz, Pedro. "Oklahoma Cooperative Managers: Their Managerial Problems and Objectives for Success." M.S. thesis, Oklahoma State University, 1972.

Bidlack, Mary Kay, ed. American Cooperation, 1985. Washington, D.C.: American Institute of Cooperation, 1985.

Caves, Richard E. and Bruce C. Petersen. "Cooperatives' Tax 'Advantages': Growth, Retained Earnings, and Equity Rotation" American Journal of Agricultural Economics. 68(May 1986):207-213.

Chen, Kung H. and Thomas A. Shimerda. "An Empirical Analysis of Useful Financial Ratios." Financial Management. 10(Spring 1981):51-60.

Dillon, William R. and Matthew Goldstein. Multivariate Analysis: Methods and Applications. New York: Wiley, 1984.

Downey, W. David and Steven P. Erickson. Agribusiness Management, 2nd ed. New York: McGraw-Hill, Inc., 1987.

Duft, Ken D. "Wage and Salary Administration." Feedstuff, September 3, 1973, pp. 26-28.

Erdman, H.E. and J.M. Tinley. The Principles of Cooperation. California Agricultural Experiment Station Bulletin No. 758., 1957.

Fischer, Martin Lee. "Financing Agricultural Cooperatives: Economic Issues and Alternatives." Ph.D. thesis, University of Minnesota, 1984.

French, C.E., J.C. Moore, C.A. Kraenzle, and K.F. Harling. Survival Strategies for Agricultural Cooperatives. Ames: Iowa State University Press, 1980.

Green, Paul E. and Donald S. Tull. Research for Marketing Decisions, 4th ed. Englewood Cliffs, N.J.: Prentice-Hall, 1978.

Hair, J. F., Jr., R. E. Anderson, and R. L. Tatham. Multivariate Data Analysis, 2nd ed. New York: Macmillan Publishing Company, 1987.

Huenemann, E. J. "What Reporting to Owners Did For our Co-op." News for Farmer Cooperatives. Washington, D.C.: USDA, Farmer Cooperative Service, September 1971, p.7.

Jewett, Alyce L. and Edwin C. Voorhies. Agricultural Cooperatives: Strength in Unity. Danville, Illinois: Interstate Printers and Publishers, Inc., 1963.

Kachigan, Sam Kash. Multivariate Statistical Analysis: A Conceptual Introduction. New York: Radius Press, 1982.

Keating, Barry and J. Holton Wilson. Fundamentals of Managerial Economics. New York: Harcourt Brace Jovanovich, Inc., 1987.

Kennedy, Peter. A Guide to Econometrics. Cambridge, Mass.: The MIT Press, 1981.

Kleinbaum, David G. and Lawrence L. Kupper. Applied Regression Analysis and Other Multivariate Methods. North Scituate, Mass.: Duxbury Press, 1978.

Knoeber, C.R. and D. L. Baumer. "Understanding Retained Patronage Refunds in Agricultural Cooperatives." American Journal of Agricultural Economics. 65(February 1983):30-37.

Larson, Richard. "Executive Compensation -- How Co-ops Compare." Farmer Cooperatives. Washington, D.C.: USDA, Farmer Cooperative Service, April 1976, p. 11.

LeVay, Clare. "Agricultural Co-operative Theory: A Review." Journal Agricultural Economics. 34(1983):1-44.

McBride, Glynn. Agricultural Cooperatives: Their Why and Their How. Westport, Connecticut. AVI Publishing Company, Inc., 1986.

Muller, Keith E. "Understanding Canonical Correlation Through the General Linear Model and Principal Components." The American Statistician. 36(November, 1982):342-354.

Oehrtman, Robert L. "Objectives, Motives, Business Style, and Personal History - How They Relate to Managerial Success." Southern Journal of Agricultural Economics. 7(December 1975):111-116.

Page, R.E., Paul D. Hummer, and B.D. Romine. Financial Analysis of Grain and Supply Cooperatives. Oklahoma State University Extension Circular E-813, Stillwater, Oklahoma.

Page, R.E. and Paul D. Hummer. Financial Statement Analysis for Agri-Business Firms. Oklahoma State University Extension Circular E-812, Stillwater, Oklahoma.

Park, David W. "Evaluating Financial Performance Using Ratio Analysis." OSU Extension Facts. Cooperative Extension Service, Oklahoma State University, No. 170.

Platt, Harlan D. Why Companies Fail: Strategies for Detecting, Avoiding, and Profiting from Bankruptcy. Lexington, Mass.: Lexington Books, 1985.

Rhodes, V. James. "The Large Agricultural Cooperative as a Competitor." American Journal of Agricultural Economics. 65(December, 1983): 1090-1095.

Roy, Ewell Paul. Cooperatives: Today and Tomorrow, 2nd ed. Danville, IL: Interstate Printers and Publishers, 1969.

Sexton, R.J. and T.E. Sexton. Taxing Co-ops: Current Treatment Is Fair, But Not For Reasons Given By Co-op Leaders." Choices, Second Quarter, 1986, pp. 21-25.

Siebert, John W. "An Early Warning Model for Grain Elevator Bankruptcy." American Journal of Agricultural Economics. 65(August 1983): 563-566.

Stewart, D.K. and Love, W.A. "A General Canonical Correlation Index." Psychological Bulletin. 70(1968):160-163.

Szilagyi, Andrew D., J.r. Management and Performance. Glenview, Ill.: Scott, Foresman, and Company, 1981.

Tabacknick, Barbara G. and Linda S. Fidell. Using Multivariate Statistics. New York: Harper and Row Publishers, Inc., 1983.

Timm, N.H. Multivariate Analysis. Monterrey, CA: Brooks/Cole, 1975.

Thompson, Bruce. Canonical Correlation Analysis: Uses and Interpretation. Sage University Paper Series on Quantitative Applications in the Social Sciences, No. 47, Beverly Hills: Sage Publishers, 1984.

U.S. Department of Agriculture, Agricultural Cooperative Service. Farmer Cooperative Statistics, 1985. Washington D.C.: ACS Service Report No. 17, December 1986, p. 13.

VanSickle, John J. and George W. Ladd. "A Model of Cooperative Finance." American Journal Agricultural Economics. 65(May 1983):273-281.

APPENDIXES

APPENDIX A

MANAGEMENT QUESTIONNAIRE

MANAGEMENT SURVEY FOR COOPERATIVE GRAIN ELEVATORS

Name of Cooperative_____

Name of Manager_____

Phone ( ) _____

1. Please rank in order of importance (1 being most important) the following factors you use in measuring success for your cooperative elevator. (Please give those of equal importance the same number in ranking.)

   _____ Growth in Trade
   _____ Net Savings
   _____ Patronage refund cash reimbursement
   _____ Return of Assets
   _____ Return on Equity
   _____ Service to Membership
   _____ Volume
   _____ Other (please specify) _____

   _____

2. Number of branch grain elevators. _____

3. If your cooperative has branches, how are they managed? (please check one)

   _____ each branch has a separate manager
   _____ centrally managed
   _____ other (please specify) _____

   _____

   _____

4. The total volume of wheat handled by my cooperative in 1985 was _____ bushels. (please include branches)

5. How much of the 1985 grain volume was hauled by the following method(s)? _____ bushels by truck; _____ bushels by rail; _____ bushels by barge.

6. Please specify the number of cooperative employees.
   _____ Full-time; _____Part-time.

7. Are employee incentives used by the cooperative (such as profit sharing)? _____ yes; _____ no.

8. Does the cooperative employ an assistant manager? _____ yes; _____ no. If no, is there a need for one? _____ yes; _____ no.

(over)

9. Are financial records grouped into departments such as feed mill operation, animal health products, petroleum and fertilizer services, etc? _____ yes; _____ no.

10. Are there services offered by the cooperative that normally don't break even? _____ yes; _____ no.

11. a. Do you feel they should be discontinued? ____ yes; ____ no.

    b. If yes, please list the services that should be discontinued. If no, please explain reason for retaining unprofitable service.

_____

_____

_____

_____

12. How often are financial statements evaluated? _____ Annually; _____ Quarterly; _____ Monthly; _____ Other (please specify)

_____

13. Of the following marketing alternatives, what amount of your 1985 grain was marketed by:

_____ bu. Back to back (sold as soon as purchased)
_____ bu. Hedged
_____ bu. Unprotected
_____ bu. Wheat Pool
_____ bu. Other (please specify) _____

_____

_____

14. What is the maximum capital expenditure you as the manager can make without the Board of Directors approval? $_____

15. Do you have a written long term plan (3 years or longer) for your cooperatives? _____ yes; _____ no. If yes, how often is the plan updated? _____ Annually; _____ Semi-annual; _____ Other

(please specify) _____

16. Do you have a written operating plan (one year plan)? _____ yes; _____ no. If yes, how often is the plan updated? _____ months

17. Do you publish a newsletter for the membership? _____ yes; ____ no. If yes, how often? _____

18. How many members belong to the coop? _____ members

19. Please rank by frequency (1 being most frequent) the type of comments and criticism customers offer?

_____ Coop input prices not competitive
_____ Other services needed
_____ Poor employee service
_____ Poor advice
_____ Wheat offers not competitive
_____ Other (please specify) _____

_____

_____

_____

20. How many members attended the last annual meeting? _____ members

21. Do you offer volume discounts to your members? ____ yes; ____ no.

22. a. What is the number of competitors with which your patrons may attempt to sell grain? _____

b. How many of these are cooperatively owned? _____

23. What is the radius of your grain procurement area? _____ miles

24. What is your formal education?

a) High School: number of years _____
b) Trade School: number of years _____
c) College: number of years _____

25. In the last two years (since May 1984) how many days have you spent at management classes, programs, seminars, etc.? _____ days

26. How many years have you been a manager with this cooperative? _____ years

27. How many years have you been a manager? _____ years

28. Do you plan to retire from your present position? _____ within 5 years; _____ 5 to 10 years; _____ beyond 10 years.

29. How many years were you a foreman and/or assistant manager before becoming a manger? _____ years

30. How many members are on the Board of Directors? _____

(over)

31. The average tenure of the members on my present Board of Directors is _____ years.

32. The average age of the members on my present Board of Directors is _____ years.

33. Do you have a Junior Board of Directors? _____ yes; _____ no.

34. In the past two years, has the Board of Directors participated in any educational or informative events concerning their duties to the cooperative? _____ yes; _____ no. If yes, how many events? _____

35. How frequent are Board of Director meetings? _____ Quarterly; _____ Monthly; _____ Other (please specify)

_____

36. What is the average attendance of the Board of Director meetings? _____ members

37. Are board members paid to attend meetings? _____ yes; _____ no.

38. Is there difficulty in getting members to serve on the Board? _____ yes; _____ no.

39. Of the salary paid to you by the cooperative in 1985, how much:

a) was in the form of a management incentive (profit share, bonus, etc.) _____%
b) was in the form of fringe benefits _____%
c) benefit program

	Coop pays	You pay
hospitalization	_____%	_____%
retirement plan	_____%	_____%
life insurance	_____%	_____%
other		
_____	_____%	_____%
_____	_____%	_____%

d) If you have a management incentive, how is it determined?

_____

_____

40. Please list in order of importance (1 being most important) the three most important problems facing your cooperative.

_____

_____

_____

_____

_____

_____

APPENDIX B

FINANCIAL DATA: AVERAGES FOR 1981-1985

TABLE XXVII

AVERAGE TOTAL NET SAVINGS AFTER TAXES

Year	Total	Small	Medium	Large
		(Dollars)		
1981	207,588	82,910	176,336	402,622
1982	166,158	72,017	140,850	318,128
1983	96,787	24,858	96,410	160,761
1984	104,293	21,709	63,622	288,402
1985	82,294	19,350	78,267	148,446

TABLE XXVIII

AVERAGE LOCAL NET SAVINGS AFTER TAXES

Year	Total	Small	Medium	Large
		(Dollars)		
1981	67,846	25,541	40,193	180,911
1982	65,526	39,599	38,297	163,095
1983	37,500	5,338	31,573	81,944
1984	45,836	-4,681	11,335	184,915
1985	14,625	-3,900	7,421	50,649

TABLE XXIX

AVERAGE TOTAL RETURN ON ASSETS

Year	Total	Small	Medium	Large
		(Percentages)		
1981	09.5	09.6	08.9	11.1
1982	07.6	08.7	06.8	09.0
1983	04.3	02.9	04.8	04.3
1984	03.7	01.7	02.7	08.1
1985	03.3	01.8	03.6	03.9

TABLE XXX

AVERAGE LOCAL RETURN ON ASSETS

Year	Total	Small	Medium	Large
		(Percentages)		
1981	03.1	0.27	0.25	0.49
1982	0.31	0.46	0.21	0.47
1983	0.15	0.03	0.17	0.21
1984	0.10	-0.13	0.02	0.51
1985	0.01	-0.12	0.02	0.11

TABLE XXXI

AVERAGE TOTAL RETURN ON EQUITY

Year	Total	Small	Medium	Large
		(Percentages)		
1981	14.6	16.6	12.9	17.5
1982	10.3	12.9	08.7	12.1
1983	04.8	02.5	05.5	04.9
1984	04.4	01.7	02.9	10.8
1985	03.8	02.3	04.2	04.0

TABLE XXXII

AVERAGE LOCAL RETURN ON EQUITY

Year	Total	Small	Medium	Large
		(Percentages)		
1981	03.8	04.1	02.6	06.6
1982	03.2	06.6	01.4	05.3
1983	00.6	-01.4	01.0	01.4
1984	00.2	-03.1	-00.9	06.3
1985	-00.9	-02.5	-00.7	00.0

TABLE XXXIII

AVERAGE DEBT TO EQUITY RATIO

Year	Total	Small	Medium	Large
		(Percentages)		
1981	68.9	77.5	60.0	86.0
1982	60.7	56.9	59.8	66.6
1983	52.5	56.8	48.9	58.5
1984	54.6	67.6	52.0	50.3
1985	48.9	54.4	46.9	49.9

TABLE XXXIV

AVERAGE CURRENT RATIO

Year	Total	Small	Medium	Large
1981	1.864	1.637	1.939	1.859
1982	2.020	2.139	2.017	1.923
1983	2.368	2.565	2.511	1.802
1984	2.366	2.121	2.512	2.176
1985	2.547	2.442	2.658	2.336

APPENDIX C

CORRELATION COEFFICIENTS BETWEEN PAIRS OF CRITERION AND EXPLANATORY VARIABLES AND BETWEEN PAIRS OF EXPLANATORY VARIABLES

TABLE XXXV

CORRELATION COEFFICIENTS BETWEEN TOTAL NET SAVINGS AFTER TAXES AND THE EXPLANATORY VARIABLES

Net Savings with:	5 Yr. Ave.	3 Yr. Ave.	1985 Data
Number of Branch Elevators	0.07	-0.00	-0.05
1985 Wheat Volume	0.45*	-0 38*	0.23
Use of Employee Incentives	0.19	0.31	0.05
Unprofitable Services	-0.20	-0.15	-0.14
Written Operating Plan	-0.42*	-0.44*	-0.42*
Coop. Membership	0.32	0.31	0.31
Volume Discounts	-0.49*	-0.50*	-0.52*
Number of Competitors	0.08	0.11	0.09
Number of Coop. Competitors	0.36*	0.39*	0.33*
Manager Programs	0.17	0.09	0.09
Yrs. as a Manager	0.25	0.30	0.19
Yrs. as Asst. Manager	0.02	-0.05	0.06
Average Tenure of Board	0.12	0.19	0.09
Management Incentives	0.53*	0.52*	0.48*
Number of Employees	0.24	0.14	0.07
Monthly Financial Evaluation	0.16	0.14	0.11
Yrs. of Manager Education	0.01	-0.01	-0.08
Debt to Equity	-0.59	-0.63*	-0.54*
Manager Salary	0.55	0.53*	0.39*

* Values are statistically significant at the .05 level.

TABLE XXXVI

CORRELATION COEFFICIENTS BETWEEN LOCAL NET SAVINGS AFTER TAXES AND THE EXPLANATORY VARIABLES

Local Net Savings:	5 Yr. Ave.	3 Yr. Ave.	1985 Data
Number of Branch Elevators	-0.11	-0.15	-0.22
1985 Wheat Volume	0.29	0.26	0.10
Use of Employee Incentives	0.18	0.15	0.02
Unprofitable Services	-0.21	-0.15	-0.15
Written Operating Plan	-0.44*	-0.42*	-0.38*
Coop. Membership	0.21	0.24	0.21
Volume Discounts	-0.52*	-0.51*	-0.55*
Number of Competitors	-0.00	0.07	0.04
Number of Coop. Competitors	0.36*	0.36*	0.30
Manager Programs	0.17	0.07	0.04
Yrs. as a Manager	0.26	0.30*	0.20
Yrs. as Asst. Manager	-0.01	-0.08	+0.04
Average Tenure of Board	0.15	0.21	0.15
Management Incentives	0.51*	0.48*	0.40*
Number of Employees	0.04	-0.02	-0.16
Monthly Financial Evaluation	0.13	0.11	0.05
Yrs. of Manager Education	-0.09	-0.10	-0.21
Debt to Equity	-0.65*	-0.62*	-0.52*
Manager Salary	0.45*	0.46*	0.33*

* Values are statistically significant at the .05 level.

TABLE XXXVII

CORRELATION COEFFICIENTS BETWEEN TOTAL RETURN
ON EQUITY AND THE EXPLANATORY VARIABLES

Return on Equity:	5 Yr. Ave.	3 Yr. Ave.	1985 Data
Number of Branch Elevators	-0.17	-0.15	-0.20
1985 Wheat Volume	0.22	0.27	0.07
Use of Employee Incentives	0.20	0.20	0.05
Unprofitable Services	-0.21	-0.22	-0.18
Written Operating Plan	-0.44*	-0.42	-0.35*
Coop. Membership	0.11	0.15	0.16
Volume Discounts	-0.62*	-0.50*	-0.58*
Number of Competitors	-0.21	-0.12	-0.15
Number of Coop. Competitors	0.15	0.22	0.08
Manager Programs	0.16	0.08	0.19
Yrs. as a Manager	0.27	0.32*	0.26
Yrs. as Asst. Manager	-0.02	-0.06	-0.00
Average Tenure of Board	0.14	0.21	0.00
Management Incentives	0.56*	0.51*	0.48*
Number of Employees	0.03	0.02	-0.00
Monthly Financial Evaluation	0.08	0.06	0.05
Yrs. of Manager Education	0.08	0.05	-0.16
Debt to Equity	-0.70*	0.74*	-0.55*
Manager Salary	0.44*	0.52*	0.33*

* Values are statistically significant at the .05 level.

TABLE XXXVIII

CORRELATION COEFFICIENTS BETWEEN LOCAL RETURN ON EQUITY AND THE EXPLANATORY VARIABLES

Local Return on Equity:	5. Yr. Ave.	3 Yr. Ave.	1985 Data
Number of Branch Elevators	-0.21	-0.19	-0.25
1985 Wheat Volume	0.21	0.24	0.09
Use of Employee Incentives	0.22	0.20	0.06
Unprofitable Services	-0.25	-0.23	-0.20
Written Operating Plan	-0.45*	-0.39*	-0.35*
Coop. Membership	0.11	0.17	0.19
Volume Discounts	-0.52*	-0.44*	-0.55*
Number of Competitors	-0.20	-0.11	-0.16
Number of Coop. Competitors	0.19	0.19	0.08
Manager Programs	0.16	0.05	0.12
Yrs. as a Manager	0.29	0.30	0.29
Yrs. as Asst. Manager	0.02	-0.04	0.03
Average Tenure of Board	0.20	0.26	0.13
Management Incentives	0.52*	0.47*	0.43*
Number of Employees	-0.03	-0.03	-0.11
Monthly Financial Evaluation	0.03	0.17	-0.02
Yrs. of Manager Education	-0.13	-0.09	-0.24
Debt to Equity	-0.74*	-0.70*	-0.59*
Manager Salary	0.43*	0.50*	0.39*

* Values are statistically significant at the .05 level.

TABLE XXXIX

CORRELATION COEFFICIENTS BETWEEN TOTAL RETURN
ON ASSETS AND THE EXPLANATORY VARIABLES

Return on Assets:	5. Yr. Ave.	3 Yr. Ave.	1985 Data
Number of Branch Elevators	-0.17	-0.15	-0.20
1985 Wheat Volume	0.20	0.25	0.07
Use of Employee Incentives	0.12	0.16	0.05
Unprofitable Services	-0.22	-0.22	-0.18
Written Operating Plan	-0.50*	-0.48*	-0.35*
Coop. Membership	+0.19	0.13	0.16
Volume Discounts	-0.63*	-0.53*	-0.58*
Number of Competitors	-0.16	-0.09	-0.15
Number of Coop. Competitors	0.25	0.29	0.08
Manager Programs	0.16	0.08	0.19
Yrs. as a Manager	0.25	0.30	0.26
Yrs. as Asst. Manager	0.04	0.00	-0.00
Average Tenure of Board	0.13	0.21	0.00^{4}
Management Incentives	0.57*	0.52*	0.48*
Number of Employees	-0.01	-0.02	-0.00^{2}
Monthly Financial Evaluation	0.09	0.09	0.05
Yrs. of Manager Education	-0.11	-0.10	-0.16
Debt to Equity	-0.77*	-0.76*	-0.55*
Manager Salary	0.41*	0.49*	0.33*

* Values are statistically significant at the .05 level.

TABLE XXXX
CORRELATION COEFFICIENTS BETWEEN LOCAL RETURN
ON ASSETS AND THE EXPLANATORY VARIABLES

Local Return on Assets:	5. Yr. Ave.	3 Yr. Ave.	1985 Data
Number of Branch Elevators	-0.19	-0.18	-0.24
1985 Wheat Volume	0.21	0.24	0.12
Use of Employee Incentives	0.16	0.17	0.08
Unprofitable Services	-0.24	-0.23	-0.21
Written Operating Plan	-0.48*	-0.43*	-0.37*
Coop. Membership	0.11	0.16	0.17
Volume Discounts	-0.55*	-0.47*	-0.58*
Number of Competitors	-0.15	-0.07	-0.09
Number of Coop. Competitors	0.27	0.25	0.17
Manager Programs	0.16	0.06	0.13
Yrs. as a Manager	0.26	0.29	0.26
Yrs. as Asst. Manager	0.06	0.01	0.11
Average Tenure of Board	0.18	0.25	0.13
Management Incentives	0.52*	0.46*	0.43*
Number of Employees	-0.07	-0.08	-0.14
Monthly Financial Evaluation	0.07	0.06	0.03
Yrs. of Manager Education	-0.13	-0.12	-0.26
Debt to Equity	-0.72*	-0.67*	-0.55*
Manager Salary	0.42*	0.48*	0.37*

* Values are statistically significant at the .05 level.

TABLE XXXXI

CORRELATION COEFFICIENTS BETWEEN EXPLANATORY VARIABLES

Explanatory Variables:	BRELEV	VOL	EMPINC	LOSPROF	OPPLAN	MEMBERS	VOLDISC	COMP
Number of Branch Elevators	1.00*							
1985 Wheat Volume	.54*	1.00*						
Use of Employee Incentives	-.16	.31	1.00*					
Non-Breakeven Services	.12	-.15	-.10	1.00*				
Written Operating Plans	.10	.08	.08	.14	1.00*			
Cooperative Membership	.34*	.39*	-.06	.24	-.08	1.00*		
Offer Volume Discounts	.02	-.23	.14	.00	.31	-.10	1.00*	
Number of Competitors	.19	.35*	.08	.00	.04	.36*	.15	1.00*
Number of Cooperative Competitors	.12	.26	-.05	-.17	-.41*	-.04	-.16	.43*
Manager Program Attended	-.24	-.05	.16	-.15	.16	-.18	.14	-.10
Years as a Manager	-.09	.12	.23	.16	-.36*	.35*	-.21	.03
Years as Asst. Manager	.19	.11	.07	-.31*	-.13	-.08	-.09	-.20
Average Tenure of Board of Directors	.01	.04	-.02	.14	-.19	.31	-.04	.43*
Management Incentives	.06	.34*	.22	.03	-.26	.26	-.39*	-.00
Number of Employees	.28	.47*	.13	-.06	.02	.52*	.17	.21
Monthly Evaluation of Financial Records	.18	.08	.15	.09	.15	-.03	.00	.03
Years of Manager Education	.26	-.00	-.03	.22	.27	-.07	.15	.06
Total Debt to Equity Ratio (5 Yr. Ave.)	.28	.01	.03	.28	.54*	-.01	.36*	.13
Manager Salary	.06	.50*	.13	-.32*	-.30	.42*	-.31	.16

TABLE XXXXI (Continued)

Explanatory Variables:	COOPCOMP	MNGPROG	MNGYRS	ASSTYRS	BDYRS	MNGINC	WORKERS	FINEVAL	MNGEDVC	D/E5	MNGSAL
Number of Branch Elevators											
1985 Wheat Volume											
Use of Employee Incentives											
Non-Breakeven Services											
Written Operating Plans											
Cooperative Membership											
Offer Volume Discounts											
Number of Competitors											
Number of Cooperative Competitors	1.00*										
Manager Program Attended	.08	1.00*									
Years as a Manager	.08	-.03	1.00*								
Years as Asst. Manager	-.04	-.22	-.20	1.00*							
Average Tenure of Board of Directors	.13	-.22	.34*	-.22	1.00*						
Management Incentives	.26	.30	.20	-.11	.10	1.00*					
Number of Employees	-.02	.16	.18	-.05	-.12	.33*	1.00*				
Monthly Evaluation of Financial Records	-.04	.27	-.08	-.13	-.05	.26	.32	1.00*			
Years of Manager Education	.04	.27	-.35*	-.25	-.14	.07	.09	.17	1.00*		
Total Debt to Equity Ratio (5 Yr. Ave.)	-.26	-.08	-.32*	-.03	-.23	-.38*	.04	.11	.28	1.00*	
Manager Salary	.24	.11	.43*	-.14	.38*	.25	.35*	.01	-.14	-.30	1.00*

* Values are statistically significant at the .05 level.

APPENDIX D

CANONICAL CROSS-LOADINGS

TABLE XXXXII

CANONICAL CROSS-LOADINGS

Contributing Factors	Five Year Analysis		Three Year Analysis	
	Total	Local	Total	Local
MNGSAL	.28	.37	.53	.45
BRELEV	-.25	-.20	-.06	-.14
VOL	.07	.17	.31	.21
EMPINC	.14	.31	.26	.26
LOSPROF	-.18	-.22	-.19	-.15
OPPLAN	-.32	-.25	-.14	-.13
MEMBERS	-.02	.09	.20	.21
VOLDISC	-.59	-.32	-.35	-.22
COMP	-.37	-.34	-.20	-.21
COOPCOMP	-.03	-.09	-.03	-.07
MNGPROG	-.02	.04	-.08	-.07
MNGYRS	.24	.32	.32	.29
ASSTYRS	.00	-.05	-.19	-.21
BDYRS	.18	.21	.21	.25
MNGINC	.50	.44	.44	.41
WORKERS	-.08	.12	.16	.20
FINEVAL	-.05	-.14	-.09	-.17
MNGEDUC	-.18	-.16	.04	-.01
D/E	-.67	-.67	-.58	-.62

VITA

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